



MULTI VTM

HYDRO KIT MEDIUM TEMPERATURE (K2) ENGINEERING MANUAL



Variable Refrigerant Flow Indoor Units
42,000 Btu/h and 96,000 Btu/h

PROPRIETARY DATA NOTICE

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A summary list of safety precautions is on page 3.

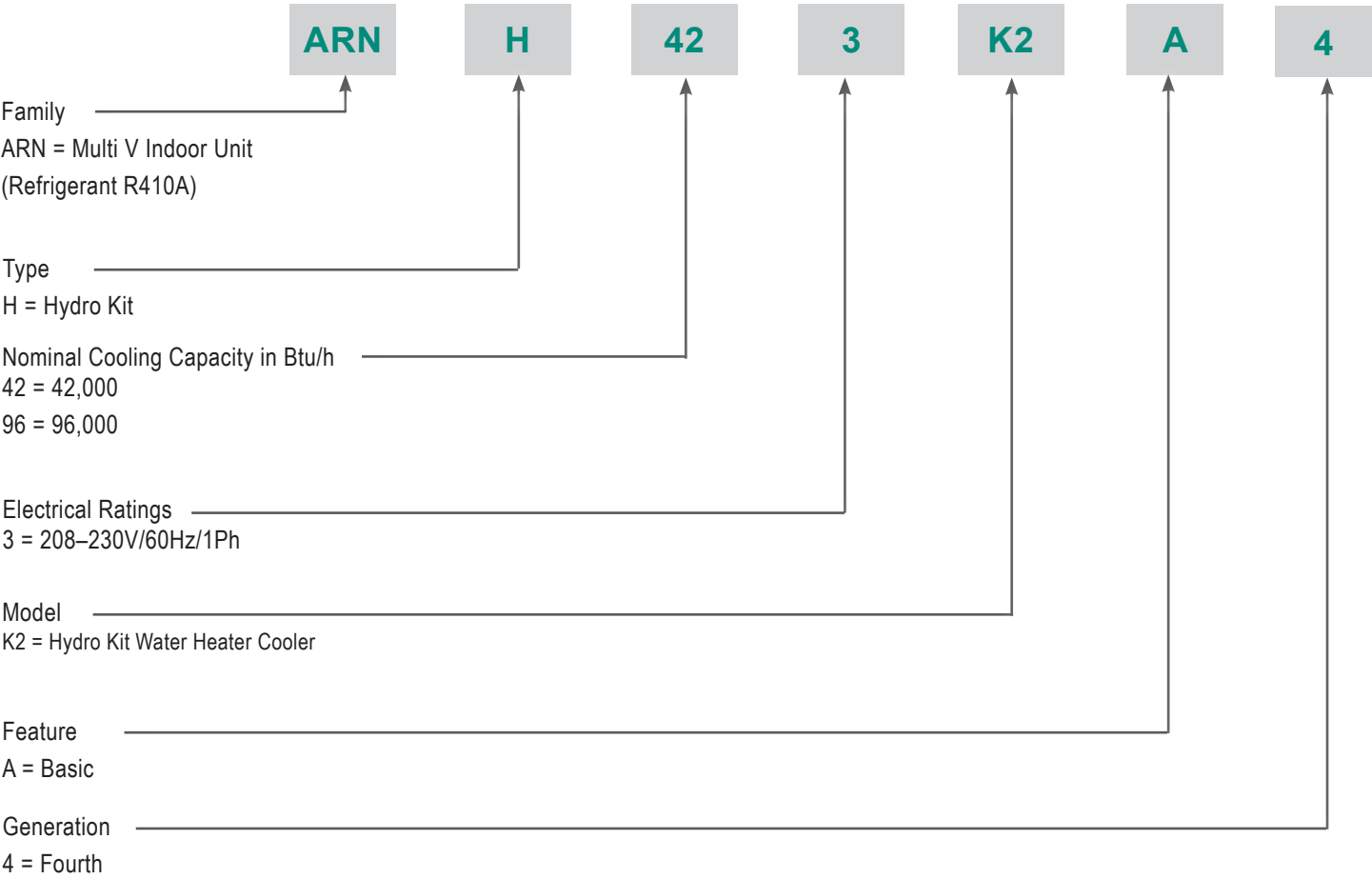
To access additional technical documentation such as submittals, indoor unit engineering manuals, installation, service, product data performance, general best practice, and building ventilation manuals, as well as white papers, catalogs, LATS software programs, and more, log in to www.lghvac.com.

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TABLE OF SYMBOLS

 DANGER	<i>This symbol indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.</i>
 WARNING	<i>This symbol indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.</i>
 CAUTION	<i>This symbol indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.</i>
Note:	<i>This symbol indicates situations that may result in equipment or property damage accidents only.</i>
	<i>This symbol indicates an action that must not be performed.</i>

UNIT NOMENCLATURE



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Hydro Kit Wall Mounted Controller

Every Hydro Kit is shipped with a Hydro Kit controller.

Versatile Control Strategies

The Hydro Kit operation can be controlled based on the temperature of the leaving water, hot water tank temperature, or the temperature of the conditioned space. The Hydro Kit interfaces with a wide selection of field-provided thermostats and sensors. To control the Hydro Kit operation based on conditioned space temperature, LG provides the designer connectivity for one of four types of sensing devices; field provided 208-230 VAC, 24 VAC thermostats, LG remote wall-mounted room sensors, or field-provided mechanical-type thermostats.

User Functions

- On / Off
- Set water storage tank temperature
- Set leaving water temperature.
- Set freeze protection temperature
- Diagnostics error code displayed
- Schedule override: User interface provides a button that makes water tank storage heating a priority over comfort heating.
- Celsius or Fahrenheit display
- Hydronic heat circulating pump test run / enable / disable

Outdoor Air Temperature Reset

The Hydro Kit controller can monitor changes in the outside ambient air temperature and reset the temperature of the water circulating through the cooling / heating system to lower system operating cost and maintain room temperature.

Scheduling

This energy saving feature can be used to control the Hydro Kit's hours of operation and system priority. The Hydro Kit wall-mounted controller has a convenient seven-day scheduling program that provides the system user with the flexibility to assign which days and hours of a week Hydro Kit operation is enabled / disabled. The user can also assign which days, or hours of each day, storage tank hot water heating has priority and which hours conditioned space heating or cooling has priority.

Multi V Equipment Compatibility

The Hydro Kit controller shares the same communications bus with other Multi V indoor units.

ARNH-K2A4 Hydro Kit models are fully compatible with Multi V 5 (by March 1, 2019), Multi V Water IV (by March 1, 2019), and Multi V S (except 24K unit; after December 2019). ARNH-K2A4 Hydro Kit models are compatible with Multi V IV Air-Source units, but without Gen4 features. ARNH-K2A4 Hydro Kit models can be used with related central control products including AC Smart, ACP, and others.

Note:

The ARNH-K2A4 Hydro Kits can be used with outdoor units manufactured after April 2019 communicating at a baud rate of 9,600 bps (Gen4 features are operational). Before April 2019, outdoor units communicate at a baud rate of 1,200 bps. For more information, review the specific outdoor unit Engineering and Installation Manuals, or contact your LG Sales Representative.

ARNH-K2A4 Hydro Kit models ARE NOT compatible with Multi V Mini, Multi V Plus II, Multi V Sync II, Multi V Space, Multi V Water II, Multi V Water Mini, single-zone, or multi-zone products.

BMS System Integration

Operating data is passed to the BMS host computer through the LG BACNet or LONWorks gateway products sold separately. All LG BMS gateway devices are IP addressable and can be accessed via the internet from any computer.

Convenient Terminal Strip

The Hydro Kit's third-party accessories terminal strip provides the installer with screw terminals for connecting field-supplied accessories such as circulating pumps, isolation and flow control valves.

Heat Exchanger with Strainer

Each unit is provided with a heavy duty, compact, brazed-plate and frame stainless steel heat exchanger. With a waterside working pressure rating of 640 psig, concerns related to the working pressure are greatly reduced.

LG provides a 50 mesh strainer for field installation with each Hydro Kit, so customers can be assured the exchanger is properly protected against large particulate build up blocking the heat exchanger channels. The strainer core is completely serviceable.

Hydro Kit Compatibility

ARNH-K2A4 Hydro Kit models are fully compatible with Multi V 5 (by March 1, 2019), Multi V Water IV (by March 1, 2019), and Multi V S (except 24K unit; after December 2019). ARNH-K2A4 Hydro Kit models are compatible with Multi V IV Air-Source units, but without Gen4 features.

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Table 1: Hydro Kit Functions.

Features		ARNH423K2A4	ARNH963K2A4
Unit Controller Based Functions	Self Diagnosis	√	√
	Auto Start	√	√
	Manual or Auto Restart ¹	√	√
	Child Lock	√	√
	Group Control ²	√	√
	Timer (on/off)	√	√
	Timer (weekly)	√	√
BMS Integration	Hydro Kit Wall Mounted Controller	√	√
	Network Solution (LGAP)	√	√
	Remote Enable/Disable via LG Dry Contact ³	PDRYCB300 / PDRYCB100	PDRYCB300 / PDRYCB100
	Power Distribution Indicator (PDI) Interface	√	√
Options	Remote Temperature Sensor ³	ZRTBS01	ZRTBS01
	Solar Heating Circuit Interface ³	PHLLA	PHLLA
Hydro Kit Based Functions	Hydronic Circuit Isolation	√	√
	Water Pump ON/ OFF Control	√	√
	Factory Mounted Flow Switch	√	√
	Conventional line voltage (208-230V) Thermostat Interface ¹	√	√
	Conventional 24 VAC Thermostat Interface ²	√	√
	Conventional Mechanical Thermostat Interface ²	√	√
	Wi-Fi Module ³	PWFMDD200	PWFMDD200
	Indirect Tank Water Pre-Heating	√	√
	Third Party Solar Heating System Flow Control	√	√
	Storage Tank Heating Operation Timer	√	√
	Water Temperature Reset	√	√
	Overheating Protection	√	√
	Emergency Heating Operation	√	√

¹Manual restart is not available when the Hydro Kit is configured for conditioned space control, using a conventional thermostat.

²Each Hydro Kit unit group must be connected to the same outdoor unit. Hydro Kit units within the same group must have the same DIP switch settings. The only DIP switch that can differ is the group control setting switch, where one Hydro Kit will be the master and the remaining Hydro Kit units will be slaves.

³Sold separately and field installed.

KEY:

√: Available.

MECHANICAL SPECIFICATIONS

Hydro Kit Water Heater / Cooler

General

The Hydro Kit can be used in conjunction with three-phase Multi V Heat Pump and Heat Recovery outdoor and water source units, and Multi V S systems (after November 2019). Multi V systems consist of an outdoor unit or water source unit, one or more indoor units or Hydro Kits, integrated system controls, and an interconnecting field-provided refrigerant pipe network containing various fittings including Y-branch kits and Header kits supplied by LG. LG components are manufactured in a facility that meets or exceeds International Organization for Standardization (ISO) 9001 and 14001. The units are listed by CSA and bear the CSA listed mark.

Casing

The Hydro Kit case is comprised of a 14-gauge coated metal frame with 20-gauge sheet metal panels. Exterior panels are cleaned and finished with a weather resistant baked enamel finish. A removable front corner panel is provided to allow access to all major components and control devices. All refrigerant and water pipe connections are on the right side of the unit.

Hydro Kit Refrigerant to Water Heat Exchanger

The water heat exchanger is a stainless steel, type SUS316, refrigerant / water plate heat exchanger designed to operate at a maximum working pressure of 640 psig. The heat exchanger water-side volume is 0.31 gallons for ARNH423K2A4 and 0.58 gallons for ARNH963K2A4.

Heat Exchanger Protection

- Factory provided 50-mesh strainer
- Internal, factory installed, flow switch
- Heat exchanger freeze protection algorithm
- Overheating protection algorithm

Microprocessor Controls

The Hydro Kit includes an integrated microprocessor controller capable of performing functions necessary to control Hydro Kit operations based on the leaving water and / or hot water tank temperature setpoint. Entering and leaving water pipe temperature sensors are factory-mounted internally to the unit case. A factory provided remote (wall-mounted) Hydro Kit controller and a hot water tank sensor / well are included for field installation. The Hydro Kit operation can be optionally controlled by sensing the conditioned space air temperature using an LG-provided remote temperature sensor (sold separately) or a field-provided manual changeover conventional thermostat.

Hydro Kit Controller

The remote wall-mounted Hydro Kit controller is provided with every unit. Power for the controller is provided via the communications cable from the Hydro Kit unit. The controller has a white resin case with a backlit LCD screen that displays the temperature setpoint, unit run-status and mode of operation (heating / cooling). User can control unit on / off, temperature adjustment, water tank heating on / off, mode selection and view temperature. The controller is used to program the Hydro Kit microprocessor resident operating parameters. Scheduling information resides on the controller.

Water Storage Tank Sensor and Well

The Hydro Kit is provided with a stainless steel 1/2 MPT hot water storage tank sensor-well that must be field installed in the wall of the indirect water storage tank (if the tank does not include one already). The sensor comes with a 39-foot cable with plug connectors.

Field Provided Components Interface

The Hydro Kit is equipped with a factory mounted terminal block with screw type connectors provided to connect waterside control devices and accessories including:

- 208-230V Pump on/off control interface
- Power/control interface for a conventional 208-230 VAC or mechanical type conditioned space temperature sensing thermostat
- Power/control interface for a three-way valve to switch water flow duty between heating the water tank and the indirect water storage conditioned space hydronic heating / cooling equipment.

Communications Cable

All communication cable to be a minimum of 18 AWG, 2-conductor, stranded, and shielded cable (RS-485). Cable insulation must be per project requirements.

External Control Component Connectivity

The Hydro Kit is equipped with a factory-mounted terminal block with screw type connectors provided to connect waterside control devices and accessories.

- 208-230V water pump on / off interface
- Power and control interface for a conventional 208-230 VAC or mechanical type conditioned space temperature sensing thermostat
- Power and control interface for a two-way valve to enable / disable indirect water storage tank heating operation

Control Functions

- Display: Degrees Fahrenheit or Celsius
- Auto restart
- Heating water temperature setpoint
- Heating water temperature deadband
- Indirect water storage tank heating operation timer (disable / enable adjustable from 0 to 10 hours)
- Enable/disable indirect water storage heating operation (requires a field-provided two-way valve)
- Outdoor air temperature based heating water temperature reset
- Water circuit pump on / off control
- Emergency operation (external sensor failure override)
- Group control (up to 16 Hydro Kits may be controlled by a single Hydro Kit controller)
- Radiant floor system condensation prevention (requires a field-provided three-way valve)
- Water pump forced operation
- Self diagnostics
- Child lock

Cold Surface Insulation

All cold surfaces are insulated to minimize the possibility of condensation forming on the components of the refrigeration circuit.

Auto Changeover Operation

Auto changeover from (heating / cooling) controlled by conditioned space temperature and requires the installation of the Hydro Kit remote controller and the optional LG remote sensor. Auto changeover operation is limited when used in conjunction with a heat pump outdoor or water source unit. Auto changeover is not available when the conditioned space temperature is controlled using a field-provided conventional thermostat.

Additional Field Provided Components Interface

- In addition to using an optional field provided 208-230VAC or mechanical thermostat to sense the conditioned space temperature, it is also permissible to use a conventional 24-volt thermostat on the K2 Heating Cooling model.
- Power / control interface for an optional, field-provided, three-way valve. The valve is used to isolate the flow of water to a portion of the water circuit where condensation will present a problem while the Hydro Kit is producing chilled water.
- Radiant floor system condensation prevention (requires a field provided two-way valve)
- Secondary heating source (i.e. solar) heating circuit water pump on/off control
- Secondary heating source (i.e. solar) heating circuit three-way valve power / control interface

Additional Control Functions

- Outdoor air temperature based chilled water temperature reset
- Leaving chilled water temperature setpoint
- Leaving chilled water deadband
- Chilled water device condensation protection temperature setpoint (cease cooling operation if the water temperature drops to / under the setpoint temperature).

Standby Power Module (IPM)

The Hydro Kit is provided with a power module designed to operate the field-provided valves in the event the Hydro Kit is shut off during Multi V defrost or oil return operation.

SPECIFICATIONS



Table 2: Hydro Kit Specifications Table.

	Hydro Kit	
	ARNH423K2A4	ARNH963K2A4
Capacity Index	42	96
Cooling Mode Performance		
Rated Capacity ¹ (Btu/h)	42,100	95,900
Entering Water Temp Range (°F)	50 - 95	50 - 95
Leaving Water Temp Range (°F)	41 - 77	41 - 77
Indoor Air Temp Setpoint Range (°F)	64 - 86	64 - 86
Heating Mode Performance		
Rated Capacity ¹ (Btu/h)	47,200	107,500
Entering Water Temp Range (°F)	50 - 122	50 - 122
Leaving Water Temp Range (°F)	68 - 122	68 - 122
Indoor Air Temp Setpoint Range (°F)	64 - 86	64 - 86
Hot Water Tank Setpoint Range (°F)	86 - 122	86 - 122
Unit Data		
Refrigerant Type	R410A	R410A
Refrigerant Control	EEV	EEV
Sound Pressure ² dB(A) Cooling/Heating	26	26
Net Unit Weight (lbs)	67	77
Shipping Weight (lbs)	79	89
Heat Rejected to Equipment Room (Btu/h)	Negligible	Negligible
Oil Type	---	---
Heat Exchanger		
Material/Type	316 Stainless / Brazed Plate	316 Stainless / Brazed Plate
Rated Water Flow (GPM)	10.4	24.3
Rated Pressure Drop ³ (ft-wg)	13.7	23.1
Range of Flow (GPM)	5.3 - 10.4	8 - 24.3
Waterside Volume (US Gallons)	0.31	0.58
Water Side Design Pressure (psig)	640	640
Piping		
Liquid Line (in, OD)	3/8 Braze	3/8 Braze
Vapor Line (in, OD)	5/8 Braze	7/8 Braze
Condensate Line (in, ID)	1-MPT	1-MPT
Water Inlet/Outlet (in, ID)	1-MPT	1-MPT

¹All capacities are net with a Combination Ratio between 95–100%.

²Sound pressure levels are tested in an anechoic chamber under ISO Standard 3745.

³Water only (no antifreeze).

¹The combination ratio range for dedicated use (all Hydro Kit units) is 50% - 100%. The combination ratio range for mixed use (Hydro Kit mixed with indoor units) is 50% - 130%.

Electrical Data

Table 3: Hydro Kit Unit Electrical Data.

Model	Voltage Range	MCA	MOP	Rated Amps (A)	Power Supply			Power Input (kW)	
					Hz	Volts	Phase	Cooling	Heating
ARNH423K2A4	187-253	0.1	15	0.08	60	208-230	1	0.01	0.01
ARNH963K2A4									

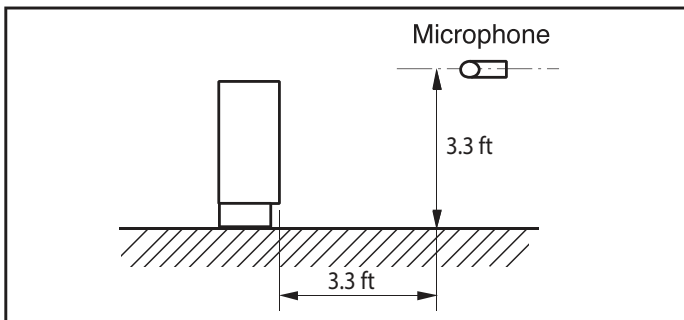
MCA = Minimum Circuit Ampacity

MOP = Maximum Overcurrent Protection

Power wiring cable is field provided and must comply with the applicable local and national codes.

Sound Pressure Level Data

Figure 1: Sound Pressure Measurement Location.

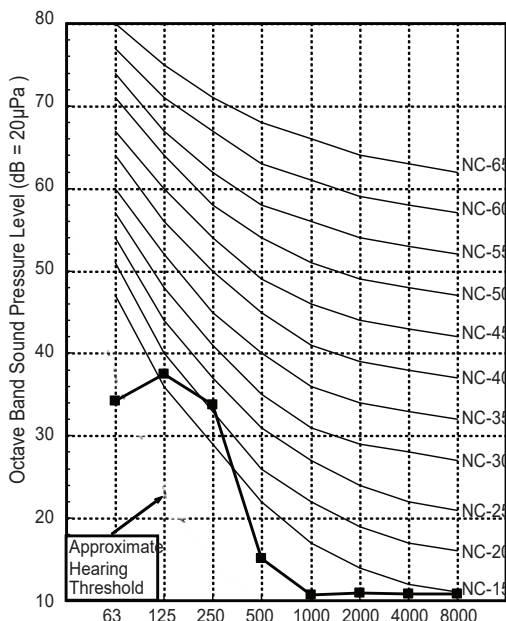


- Measurement taken 3.3' above finished floor, and at a distance of 3.3' from face of unit.
- Measurements taken with no attenuation and units operating at full load normal operating condition.
- Sound level will vary depending on a range of factors such as construction (acoustic absorption coefficient) of particular area in which the equipment is installed.
- Sound power levels are measured in dB(A)±1.
- Tested in anechoic chamber per ISO Standard 3745.

Table 4: Hydro Kit Unit Sound Pressure Level.

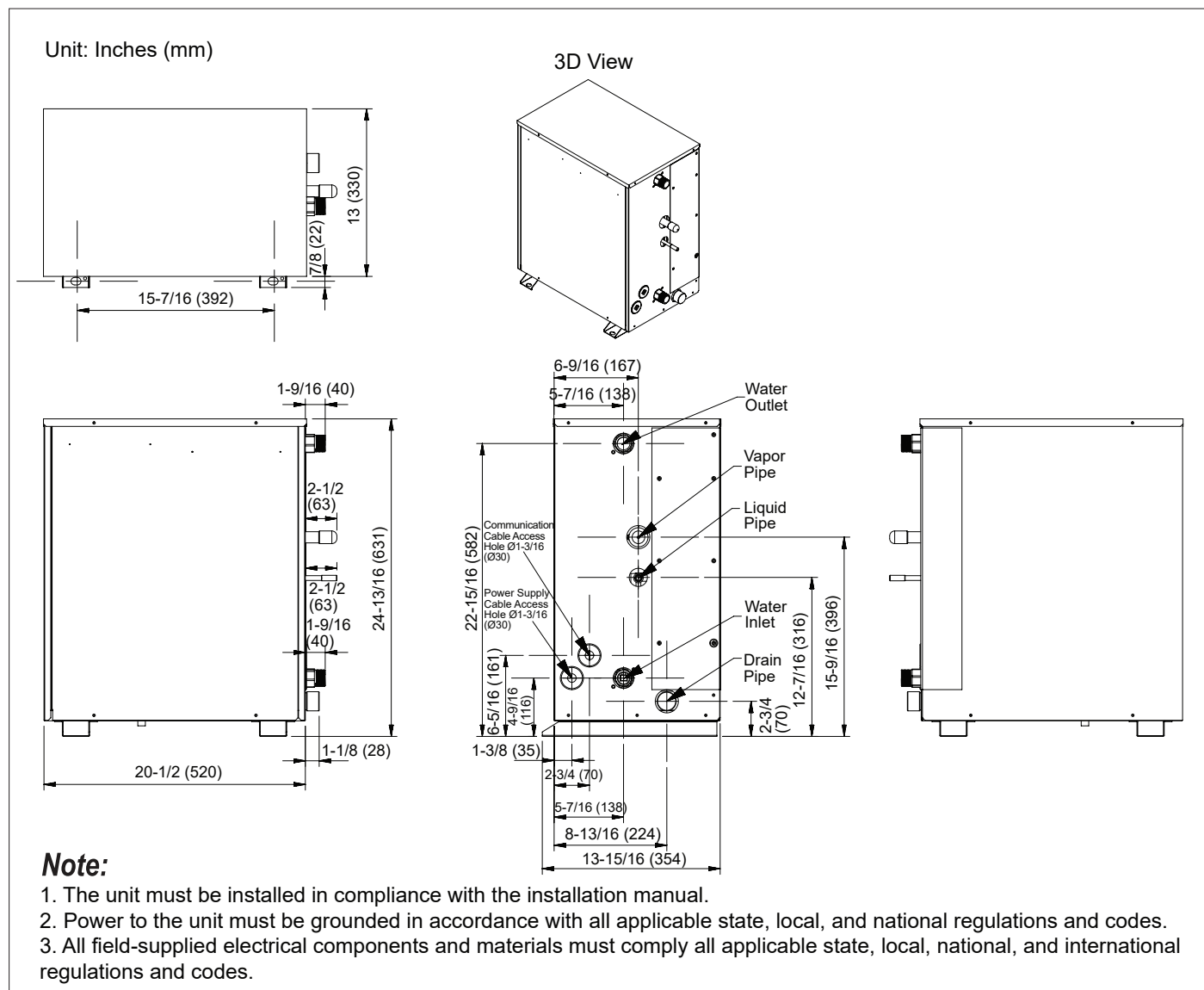
Models	Sound Pressure Level dB (A)
ARHN423K2A4, ARHN963K2A4	26

Figure 2: ARHN423-963K2H4 Sound Pressure Level Diagram.



DIMENSIONS

ARNH423K2A4, ARNH963K2A4



Selecting the Best Location

⚠ DANGER

To avoid the possibility of fire, ⚠ do not install the unit in an area where combustible gas will generate, flow, stagnate, or leak. Failure to do so will cause serious bodily injury or death. Before beginning installation, read the safety summary at the beginning of this manual.

Select a location for installing Hydro Kits that meets the following conditions:

Do's

- Install the Hydro Kit indoors.
- Where the floor is solid and has enough structural strength to bear four times the weight of the Hydro Kit.
- Use a level indicator to ensure the unit is installed on a level plane.
- Place the Hydro Kit where drainage can be obtained easily, and to minimize the length of the condensate drain piping.
- Include enough space for service access.
- Locate the Hydro Kit in a location where it can be easily connected to the outdoor unit / heat recovery unit.

⚠ Do Not's

- Do not install the unit near high-frequency generators.
- Do not install the unit where it will be subjected to direct thermal radiation from other heat sources.
- Do not install the unit in a location where acidic solution and spray (sulfur) are often used.
- Do not use the unit in environments where sulfuric gas is present.
- Do not install the unit near a heat or steam source, or where considerable amounts of oil, iron powder, or flour are used. (These materials will generate condensate, cause a reduction in heat exchanger efficiency, or the drain to malfunction. If this is a potential problem, install a ventilation fan large enough to vent out these materials.)
- Do not install the unit near a doorway.

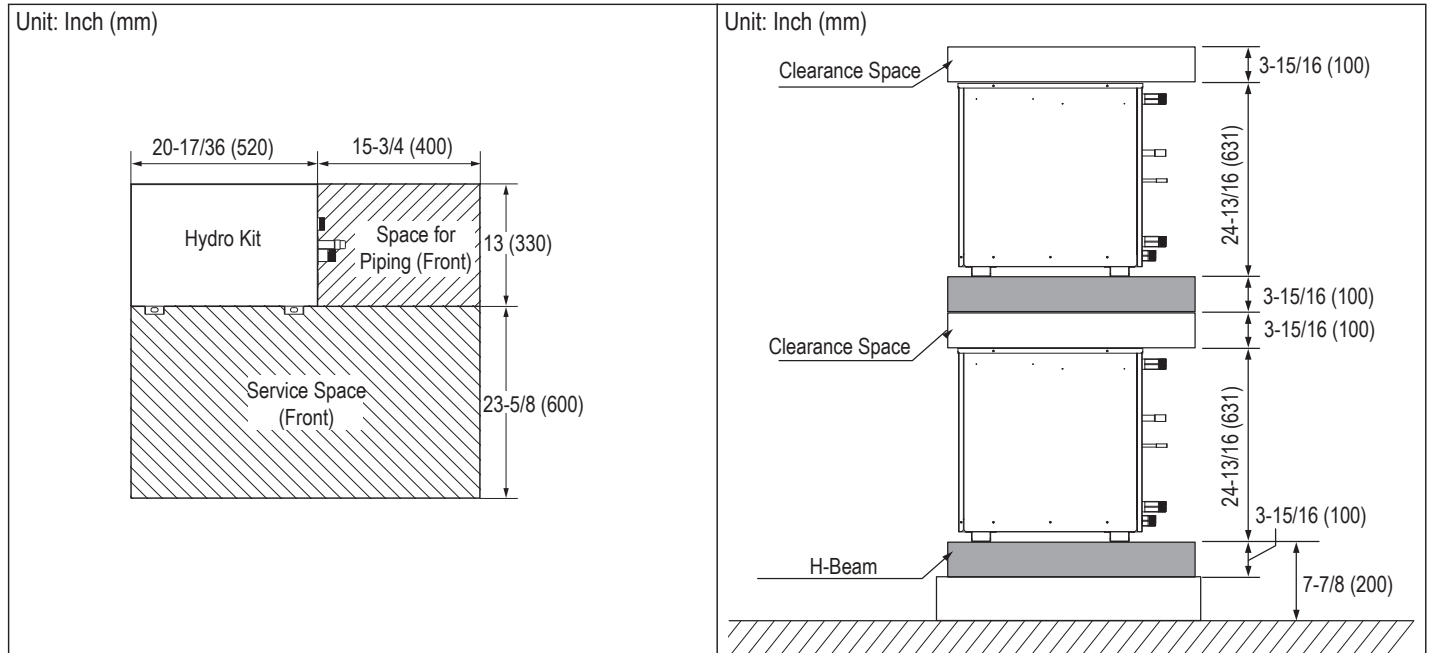
The unit will be damaged, will malfunction, and / or will not operate as designed if installed in any of the conditions listed.

Note:

- Hydro Kits must not be placed in an environment where the Hydro Kits will be exposed to harmful volatile organic compounds (VOCs) or in environments where there is improper air make up or supply or inadequate ventilation. If there are concerns about VOCs in the environment where the Hydro Kits are installed, proper air make up or supply and/or adequate ventilation must be provided. Additionally, in buildings where Hydro Kits will be exposed to VOCs, consider a third party factory-applied epoxy coating to the coils for each Hydro Kit where the entire coil is dipped, not sprayed.
- If the unit is installed near a body of water, the installation parts are at risk of corroding. Appropriate anti-corrosion methods must be taken for the unit and all installation parts.

CLEARANCE AND FOUNDATION REQUIREMENTS

Figure 3: Clearance Requirements.



Foundation

- Tightly attach the Hydro Kit with bolts as shown below so that the unit will not fall.
- Noise and vibration could transfer to the floor or walls, so install rubber anti-vibration isolation pads between the mounting feet and the base. The base pad must be more than 8 inches (200 mm).

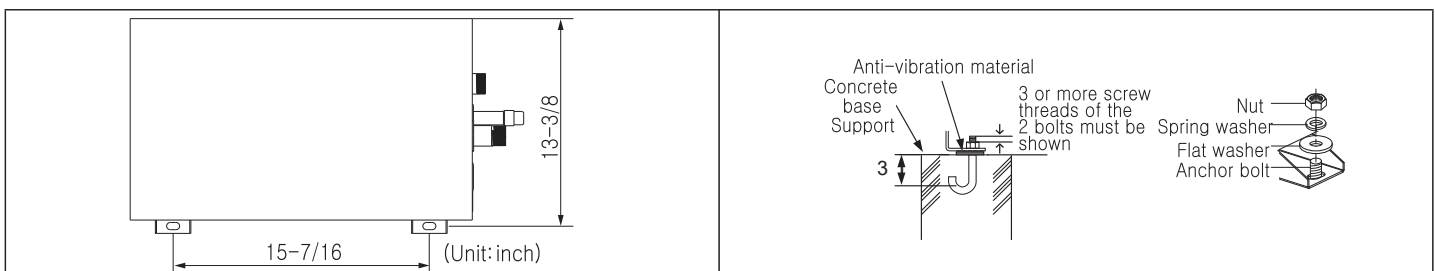
⚠ WARNING

- Ensure that the floor / chosen location has enough strength to support the weight of the Hydro Kit. If it does not have sufficient strength, the Hydro Kit will fall and cause physical injury or death.
- Ensure the Hydro Kit is firmly attached to the foundation. Any deficiency in installation will cause unit to fall, resulting in physical injury or death.

Note:

- Ensure that the floor / chosen location has enough strength to support the weight of the Hydro Kit. If it does not have sufficient strength, the Hydro Kit will fall and cause damage to the unit.
- Ensure the Hydro Kit is firmly attached to the foundation. Any deficiency in installation will cause unit to fall, resulting in damage to the unit.

Figure 4: Foundation Requirements.



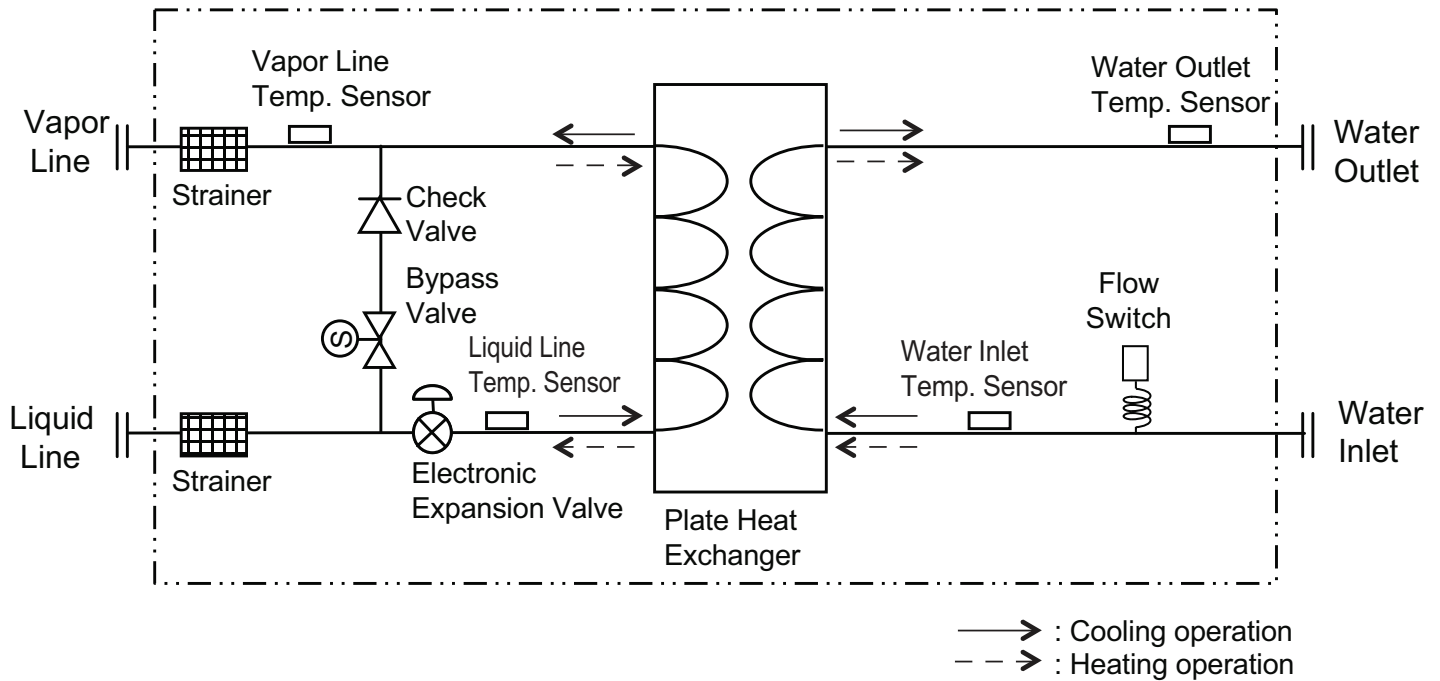


Table 5: Hydro Kit Piping Schematic Legend.

Description	PCB Socket	Remarks
Vapor Line Temperature Sensor	CN_PIPE/OUT	Multi V refrigerant cycle
Liquid Line Temperature Sensor	CN_PIPE/IN	Multi V refrigerant cycle
Water Inlet Temperature Sensor	CN_TH3	Water Inlet and Water Outlet sensors are connected to 4 pin connector CN_TH3
Water Outlet Temperature Sensor		

*Air Temperature sensor is an optional accessory and is sold separately based on design requirements.

WIRING DIAGRAM

ARNH423K2A4, ARNH963K2A4

MULTI VTM
HYDRO KIT

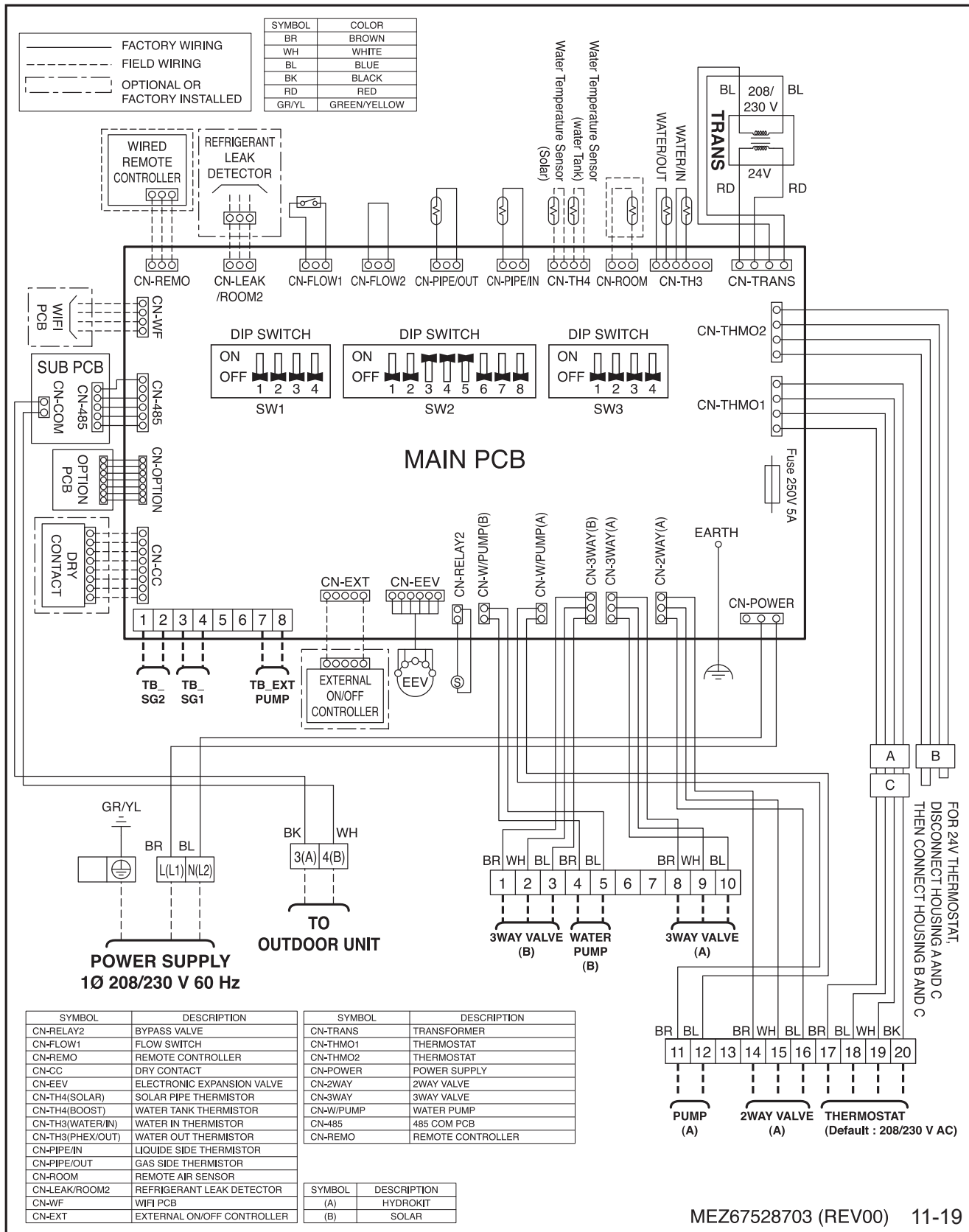


Table 6: LG Included Accessories.

Accessory	Model No.	Connection	Description	Use
Hydro Kit Unit Controller ¹	AKB74855309	CN-REMO	Remote wall mounted controller	Schedules, sets operational parameters and monitors system
Standby Power Module ¹	PRIPO	CN-WRITE & CN-EEV	Backup power to close EEV valve if power failure occurs during Multi V defrost or oil return	Closes EEV if power outage occurs during defrost or oil return
Indirect Water Storage Tank Sensor Well	MEG61846102	Indirect Heating Tank Wall	Mounting for the indirect water tank storage temperature sensor complete with 39 feet of cable with plug connector	
Hot Water Storage Tank Sensor ^{1,2}	EBG61325701	CN-TH4*	Water storage tank sensor	Monitors the Hydro Kit indirect water storage tank temperature
Water Circuit Strainer ³	MJC57132402	Inlet Pipe	50 Mesh; install on inlet pipe to heat exchanger	Keeps large particulate from entering the heat exchanger

¹Must use LG provided communications cable.

²Must have contacts rated for 208-230/60/1.

³1" FPT both ends.

*CN-TH4 connection can be used with either the Hot Water Storage Tank Sensor (LG Included Accessory; see table above) OR the Solar Heating System Interface Kit with its sensor (LG Optional Accessory; see table below). Both accessories CANNOT be connected to CH-TH4 at the same time.

Table 7: LG Optional Accessories (sold separately).

Accessory	Model No.	Connection	Description	Use
Wired Remote Extension Cable ¹	PZCWRC1	---	33 foot extension cable assembly	Extends the length of the Hydro Kit Unit Controller communications cable beyond 33 feet (cannot be used to extend tank sensor cable length)
Solar Heating System Interface Kit	PHLLA	CN-TH4 (Solar)*	Kit includes solar heating system tank sensor/cable and tee fitting sensor well.	Operates the Hydro Kit with a water storage tank.
Ancillary (Solar) Heating System Tank Replacement Sensor ^{1,2,3}	MEG61846102	CN-TH4 (Solar)*	Solar heating water storage tank sensor with 33 feet of cable and plug connector	Monitors the solar heating system water circuit temperature
Remote Temperature Sensor	ZRTBS01	CN-ROOM	Sensor with 50 foot communications cable and plug connector	Monitors and/or controls (optional) the Hydro Kit based on air temperature
Dry Contact	PDRYCB300 / PDRYCB100	CN-CC	Mounts inside the unit cabinet and provides a external binary signal control interface	Enables/disables operation from an external signal
Wi-Fi Module	PWFMD200	CN-WF	Connect for Wi-Fi capabilities	Enables Wi-Fi capabilities.

¹Must use LG provided communications cable.

²Field supplied thermal paste required.

³This sensor is included when ordering the PHLLA Solar Heating Interface Kit.

*CN-TH4 connection can be used with either the Hot Water Storage Tank Sensor (LG Included Accessory; see table above) OR the Solar Heating System Interface Kit with its sensor (LG Optional Accessory; see table below). Both accessories CANNOT be connected to CH-TH4 at the same time.

Note

Maximum combined current draw of all connected accessories must be equal to or less than 5 Amps@ 208-230/60/1. Refer to wiring diagrams for detailed terminal block information.

Table 8: Third-Party Accessories (Sold Separately).

Accessory	Connections	Voltage Options	Description	Use
Hydro Kit Circuit Water Pump Interlock	TB-11,12	208-230/60/1	Hydro Kit water circuit circulating pump interlock (use a field-provided pilot relay)	Provides pump On / Off control based on Hydro Kit control logic
Solar Heating Circuit Water Pump Interlock ^{1,2}	TB-4,5	208-230/60/1	Solar heating circuit circulating pump interlock (use a field-provided pilot relay)	Provides pump On / Off control based on Hydro Kit control logic.
208-230/60/1 Conventional Thermostat ³	TB-17,18,19,20 & Harness Plug C to A	208-230/60/1	Single stage heating / cooling manual changeover	Monitors and / or controls (optional) the Hydro Kit based on the conditioned space temperature.
24 VAC Conventional Thermostat ³	TB-17,18,19,20 & Harness Plug C to B	24 VAC	Single stage heat/cool, must be manual changeover model	Monitors and / or controls (optional) the Hydro Kit based on the conditioned space temperature.
Mechanical Thermostat	TB-17,18,19,20 & Harness Plug C to A	---	Single stage heating only	Monitors and / or controls (optional) the Hydro Kit based on the conditioned space temperature.
Hydro Kit Circuit 3-Way Diverting Valve	TB-8,9,10	208-230/60/1	Valve (A) 208-230/60/1 3-wire SPDT	Diverting valve - circulates water to / from the comfort conditioning equipment and the Hydro kit water storage tank.
Hydro Kit Circuit 2-Way Isolation Valve	TB-14,15,16	208-230/60/1	Valve (A) 208-230/60/1 2-wire NO or NC	Partial circuit water Isolation valve- prevents condensate from forming on floors containing in-floor heating pipe while operating in the cooling mode.
Solar Heating Circuit 3-Way Diverting Valve	TB-1,2,3	208-230/60/1	Valve (B) 208-230/60/1 3-wire SPDT	Diverting valve circulates water to / from the ancillary heating circuit and the Hydro kit heating circuit.

TB = Terminal Block NO = Normally Open
NC = Normally Closed SPDT = Single Pole Double Throw

¹Must have contacts rated for 208-230/60/1.
²1" FPT both ends.
³Must have contacts rated for 24VAC.

Note
Maximum combined current draw of all connected accessories must be equal to or less than 5 Amps@ 208-230/60/1. Refer to wiring diagrams for detailed terminal block information.

Table 9: LG Optional Central Controllers / Gateways (Sold Separately).

Controller	Model No.
LG MultiSITE™ Communications Manager	PBACNBTR0A
AC Smart™ 5	PACS5A000
ACP 5	PACP5A000
ACP LonWorks®	PLNWKB100

LonWorks® is a registered trademark of Echelon Corporation.

SELECTION PROCESS FOR AIR-SOURCE SYSTEMS (MULTI V 5 AND MULTI V S)

Applying Correction Factors on page 21

Operation Limits on page 29

Capacity Correction Factor by Temperature

Capacity Calculation Methods

Hydro Kit Capacity + Indoor Unit Capacity = Total Capacity

$$Q_{ODU} \times (I_{HK} / I_{TOTAL}) \times F_{TC,T_{HK}} \times F_{TC,W_{HK}} \times F_{TC,C_{HK}} \times F_{TC,P_{ODU}} \times F_{TC,D_{ODU}} = \text{Hydro Kit Capacity}$$

Q_{ODU} = Air-Source by Air or temperature, and capacity ratio at standard indoor temperature. Standard indoor temperature is 80.6°F DB / 66.2°F WB on cooling mode, 68°F DB on heating mode. Refer to the Multi V 5 or Multi V S capacity tables.

$F_{TC,T_{HK}}$ = Capacity Correction Factor by Outdoor Air Temperature (See Figures 5 and 12).

$F_{TC,W_{HK}}$ = Capacity Correction Factor by Water Flow Rate (See Figures 6 and 7, and Figures 13 and 14).

$F_{TC,C_{HK}}$ = Capacity Correction Factor by Combination Ratio (See Pages 29 and 30).

$F_{TC,P_{ODU}}$ = Capacity Correction Factor by Refrigerant Piping Length (Refer to the correction factors of the outdoor unit. For Hydro Kit applications, it will always be one [1]).

$F_{TC,D_{ODU}}$ = Capacity Correction factor by Defrost Operation (Air-Source Units Only; Refer to the correction factors of the outdoor unit).

I_{HK} = Capacity Index for Hydro Kit (See Page 10).

I_{TOTAL} = Sum of Capacity Index for Hydro Kits Combined with Indoor Units (See Table 14).

Power Input Calculation Methods

Hydro Kit Power Input + Indoor Unit Power Input = Total Power Input

$$P_{IODU} \times (I_{HK} / I_{TOTAL}) \times F_{PI,T_{HK}} \times F_{PI,W_{HK}} \times F_{PI,C_{HK}} = \text{Hydro Kit Power Input}$$

P_{IODU} = Air-Source Power Input by Air temperature, and capacity ratio at standard indoor temperature. Standard indoor temperature is 80.6°F DB / 66.2°F WB on cooling mode, 68°F DB on heating mode.

$F_{PI,T_{HK}}$ = Power Input Correction Factor by Outdoor Air Temperature (See Figures 9 and 16).

$F_{PI,W_{HK}}$ = Power Input Correction Factor by Water Flow Rate (See Figures 10 and 11, and Figures 17 and 18).

$F_{PI,C_{HK}}$ = Power Input Correction Factor by Combination Ratio (See Pages 29 and 30).

I_{HK} = Capacity Index for Hydro Kit (See Page 10).

I_{TOTAL} = Sum of Capacity Index for Hydro Kits Combined with Indoor Units (See Table 14).

When calculating at maximum and minimum temperatures of the outdoor unit capacity range and power input, use the same temperature values for both.

For example, when calculating Heating PI with capacity table of Multi V 5 Heat Pump at 59°F DB, use the same value of PI at 59°F DB.

SELECTION PROCESS

Hydro Kits with Multi V 5 and Multi V S Air-Source Systems

Applying Cooling Capacity and Power Input Correction Factors

To apply and choose a Hydro Kit for use with Multi V 5 (by March 1, 2019) and Multi V S (except 24K unit; after December 2019) Air-Source systems, the designer needs to know the corrected cooling capacity (Btu/h), the cooling power input (kW), the corrected heating capacity (Btu/h), the heating power input (kW), water pressure drop through the heat exchanger (ft.-w.g.), and combination ratio limits. The following pages present the necessary steps and processes to obtain all the information needed.

Note:

ARNH-K2A4 Hydro Kit models are compatible with Multi V IV Air-Source units, but without Gen4 features.

Note:

The ARNH-K2A4 Hydro Kits can be used with outdoor units manufactured after April 2019 communicating at a baud rate of 9,600 bps (Gen4 features are operational). Before April 2019, outdoor units communicate at a baud rate of 1,200 bps. For more information, review the specific outdoor unit Engineering and Installation Manuals, or contact your LG Sales Representative.

Calculating Corrected Cooling Capacity

To obtain the corrected cooling capacity at design conditions, first see the "Hydro Kit Specifications Table" on page 10, and find the rated cooling capacity of the chosen Hydro Kit. Use the charts on the following pages for the three (3) additional factors needed to determine the corrected cooling capacity:

- Factor A = Outdoor Ambient Air DB Temperature (°F) (Multi V 5 or Multi V S Air-Source).
- Factor B = Water Flow Rate (GPM).
- Factor C = Antifreeze Additive (% by Weight).

Then, to calculate, use:

Rated Capacity (Btu/h) x Factor A x Factor B x Factor C = Corrected Cooling Capacity (Btu/h).

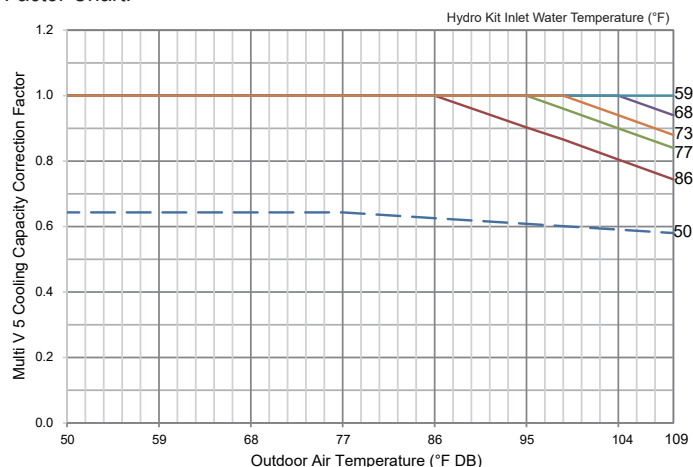
Cooling Capacity Correction Charts for Multi V 5 and Multi V S Air-Source Units

Factor A: Outdoor Ambient Air DB Temperature (°F)

For use in projects with a design outdoor ambient air temperature above 50°F.

1. Find the design outdoor air temperature on the chart.
2. Find the Hydro Kit design inlet water temperature.
3. Use the intersecting datapoint to find the cooling capacity correction factor by air-source unit outdoor ambient air temperature.

Figure 5: Multi V 5 and Multi V S Air-Source Cooling Capacity Correction Factor Chart.



Hydro Kits with Multi V 5 and Multi V S Air-Source Systems Applying Cooling Capacity and Power Input Correction Factors

Factor B: Water Flow Rate (GPM)

1. Find the cooling design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the cooling capacity correction factor by water flow rate.

Figure 6: ARNH423K2A4 Water Flow Rate Cooling Capacity Correction Factor.

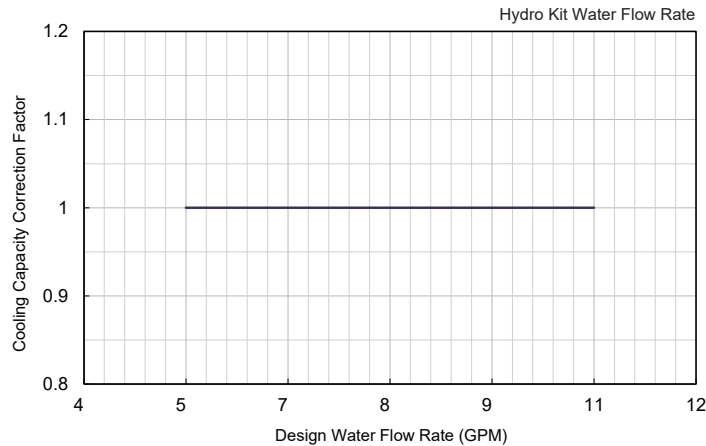
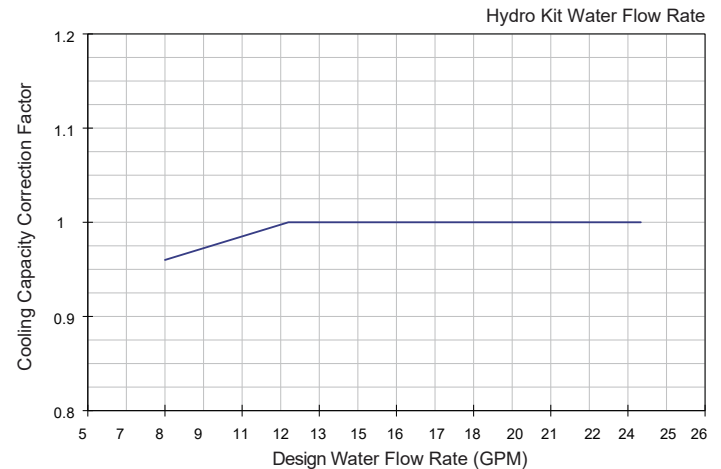


Figure 7: ARNH923K2A4 Water Flow Rate Cooling Capacity Correction Factor.



Factor C: Antifreeze Additive (% by Weight)

If the water flowing through the Hydro Kit heat exchanger has the potential to freeze, an antifreeze agent such as ethylene glycol, propylene glycol, or methanol must be added to the water circuit. The antifreeze will reduce the ability of the Hydro Kit to exchange heat energy, and this reduction must be taken into account.

1. Find the antifreeze percent by weight on the chart.
2. Find the antifreeze being considered.
3. Use the intersecting datapoint to find the cooling capacity correction factor. See also table below for cooling capacity correction factor datapoints at specific antifreeze concentration level percentages.

Figure 8: Cooling Capacity Correction by % Antifreeze.

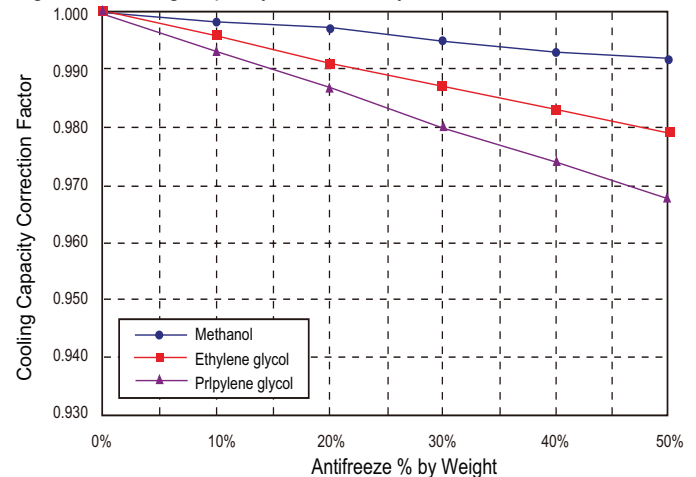


Table 10: Cooling Capacity Correction by % Antifreeze Chart.

Type	Antifreeze Concentration Level (% by Weight)				
	10%	20%	30%	40%	50%
Methanol	0.998	0.997	0.995	0.993	0.992
Ethylene Glycol	0.996	0.991	0.987	0.983	0.979
Propylene Glycol	0.993	0.987	0.980	0.974	0.968

SELECTION PROCESS



Hydro Kits with Multi V 5 and Multi V S Air-Source Systems Applying Cooling Capacity and Power Input Correction Factors

Calculating Corrected Cooling Power Input

To obtain the corrected cooling power input, first see the “Hydro Kit Electrical Data Table” on page 11, and find the rated cooling power input of the chosen Hydro Kit. Use the charts on the following pages for the two (2) additional factors needed to determine the corrected cooling power input:

- Factor D = Outdoor Ambient Air DB Temperature (°F) (Multi V 5 or Multi V S Air-Source).
- Factor E = Water Flow Rate (GPM).

Then, to calculate, use:

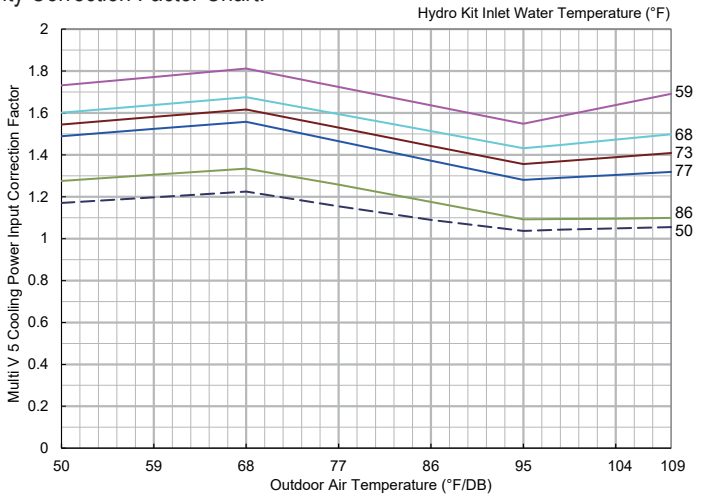
$$\text{Rated Capacity (kW)} \times \text{Factor D} \times \text{Factor E} = \text{Corrected Cooling Power Input (kW)}$$

Cooling Power Input Charts for Multi V 5 and Multi V S Air-Source Units

Factor D: Outdoor Ambient Air DB Temperature (°F)

1. Find the design outdoor air temperature on the chart at right.
2. Find the Hydro Kit inlet water temperature.
3. Use the intersecting datapoint to find the cooling power input correction factor.

Figure 9: Multi V 5 and Multi V S Air-Source Cooling Power Input Capacity Correction Factor Chart.



Factor E: Water Flow Rate (GPM)

1. Find the cooling design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the cooling power input correction factor by water flow rate.

Figure 10: ARNH423K2A4 Water Flow Rate Power Input Heating Correction Factor.

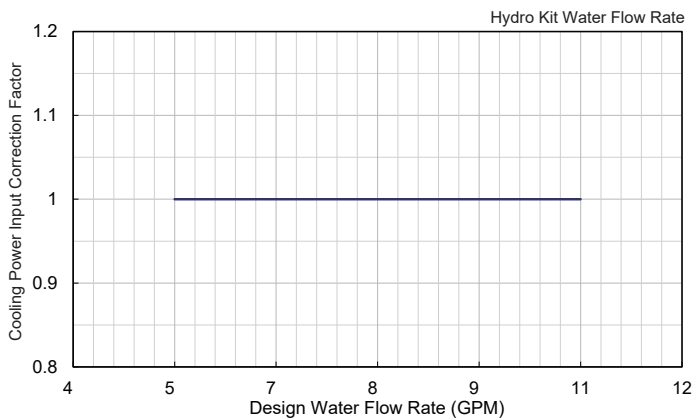
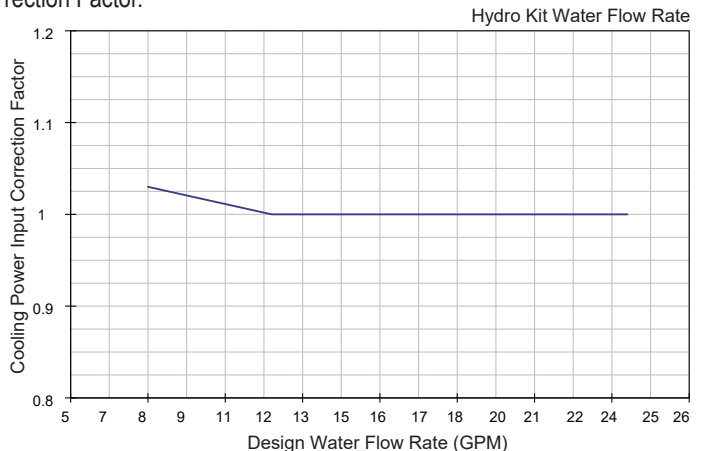


Figure 11: ARNH923K2A4 Water Flow Rate Power Input Heating Correction Factor.



Hydro Kits with Multi V 5 and Multi V S Air-Source Systems Applying Heating Capacity and Power Input Correction Factors

Calculating Corrected Heating Capacity

To obtain the corrected heating capacity at design conditions, first see the “Hydro Kit Specifications Table” on page 10, and find the rated heating capacity of the chosen Hydro Kit. Use the charts on the following pages for the four (4) additional factors needed to determine the corrected heating capacity:

- Factor A = Outdoor Ambient Air DB Temperature (°F) (Multi V 5 or Multi V S Air-Source).
- Factor B = Water Flow Rate (GPM).
- Factor C = Antifreeze Additive (% by Weight).
- Factor D = Outdoor Unit Coil Frost Accumulation.

Then, to calculate, use:

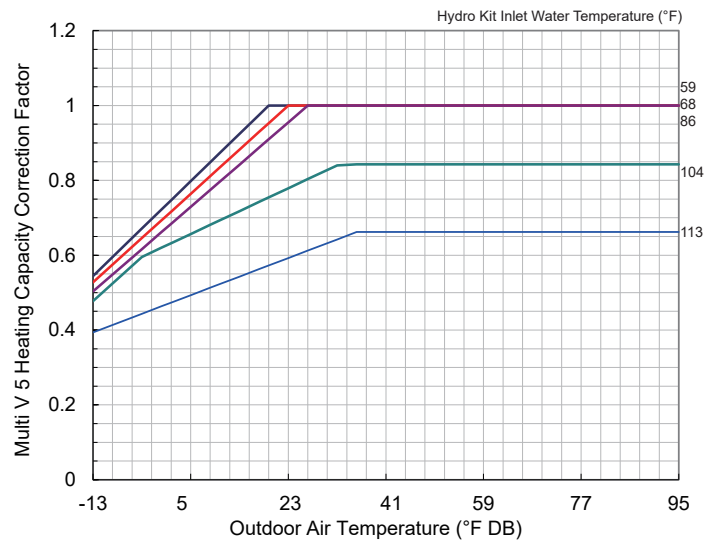
Rated Capacity (Btu/h) x Factor A x Factor B x Factor C x Factor D = Corrected Heating Capacity (Btu/h).

Heating Capacity Correction Charts for Multi V 5 and Multi V S Air-Source Units

Factor A: Outdoor Ambient Air DB Temperature (°F)

1. Find the design outdoor air temperature on the chart.
2. Find the Hydro Kit inlet water temperature.
3. Use the intersecting datapoint to find the heating capacity correction factor by air-source ambient air temperature.

Figure 12: Multi V 5 and Multi V S Air-Source Heating Capacity Correction Factor Chart.



Factor B: Water Flow Rate (GPM)

1. Find the heating design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the heating capacity correction factor by water flow rate.

Figure 13: ARNH423K2A4 Water Flow Rate Heating Capacity Correction Factor.

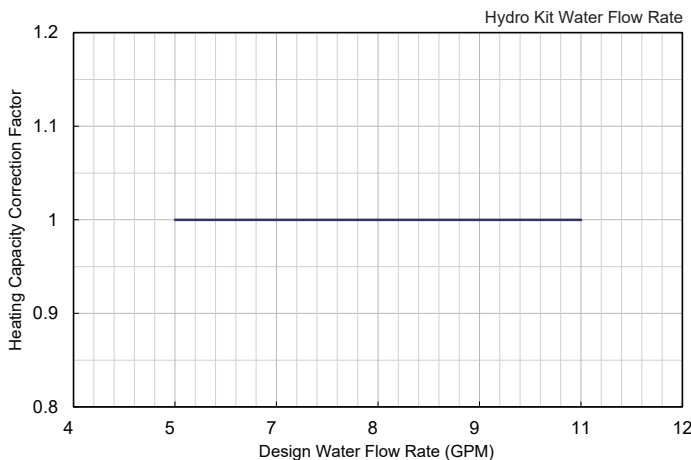
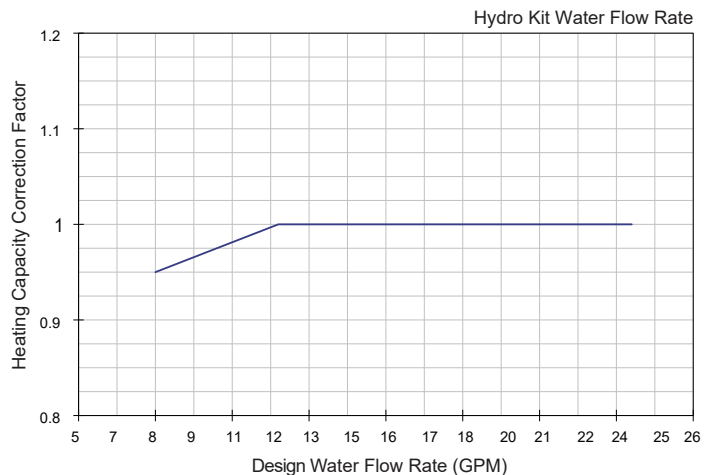


Figure 14: ARNH923K2A4 Water Flow Rate Heating Capacity Correction Factor.



SELECTION PROCESS

Hydro Kits with Multi V 5 and Multi V S Air-Source Systems

Applying Heating Capacity and Power Input Correction Factors

Factor C: Antifreeze Additive (% by Weight)

If the water flowing through the Hydro Kit heat exchanger has the potential to freeze, an antifreeze agent such as ethylene glycol, propylene glycol, or methanol must be added to the water circuit. The antifreeze will reduce the ability of the Hydro Kit to exchange heat energy, and this reduction must be taken into account.

1. Find the antifreeze percent by weight on the chart.
2. Find the antifreeze being considered.
3. Use the intersecting datapoint to find the heating capacity correction factor. See also table below for heating capacity correction factor datapoints at specific antifreeze concentration level percentages.

Figure 15: Heating Capacity Correction Factor by Water Flow Rate.

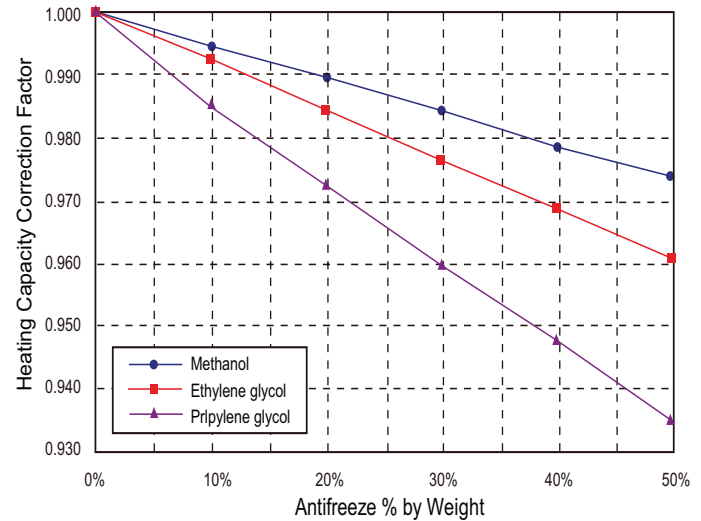


Table 11: Heating Capacity Correction by % Antifreeze Chart.

Type	Antifreeze Concentration Level (% by Weight)				
	10%	20%	30%	40%	50%
Methanol	0.995	0.990	0.985	0.979	0.974
Ethylene Glycol	0.993	0.985	0.977	0.969	0.961
Propylene Glycol	0.966	0.973	0.960	0.948	0.935

Factor D: Outdoor Unit Coil Frost Accumulation.

For air-source systems only. Calculate the Frost Accumulation Correction Factor using the information in the table at right. Applies to both Hydro Kit models.

Table 12: Outdoor Unit Frost Accumulation Capacity Correction Factor.

Coil Inlet Air Temp DB (°F)	19.4	23.0	26.6	32.0	37.4	41.0	44.6
Capacity Correction Factor	0.98	0.95	0.93	0.86	0.93	0.96	1.0

Hydro Kits with Multi V 5 and Multi V S Air-Source Systems Applying Heating Capacity and Power Input Correction Factors

Calculating Corrected Heating Power Input

To obtain the corrected heating power input, first see the "Hydro Kit Electrical Data Table" on page 11, and find the rated heating power input of the chosen Hydro Kit. Use the charts on the following pages for the two (2) additional factors needed to determine the corrected heating power input:

- Factor D = Outdoor Ambient Air DB Temperature (°F) (Multi V 5 or Multi V S Air-Source).
- Factor E = Water Flow Rate (GPM).

Then, to calculate, use:

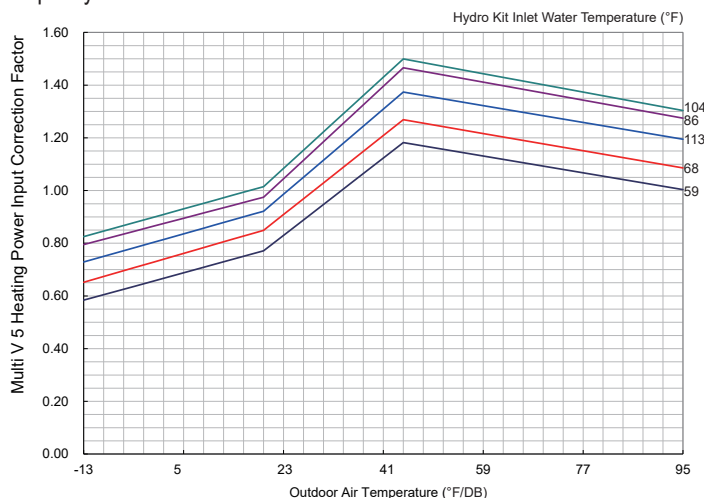
$$\text{Rated Capacity (kW)} \times \text{Factor D} \times \text{Factor E} = \text{Corrected Heating Power Input (kW)}$$

Heating Power Input Charts for Multi V 5 and Multi V S Air-Source Units

Factor D: Outdoor Ambient Air DB Temperature (°F)

1. Find the design outdoor air temperature.
2. Find the Hydro Kit inlet water temperature.
3. Use the intersecting datapoint to find the heating power input correction factor.

Figure 16: Multi V 5 and Multi V S Air-Source Heating Power Input Capacity Correction Factor Chart.



Factor E: Water Flow Rate (GPM)

1. Find the heating design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the heating power input correction factor by water flow rate.

Figure 17: ARNH423K2A4 Water Flow Rate Power Input Heating Correction Factor.

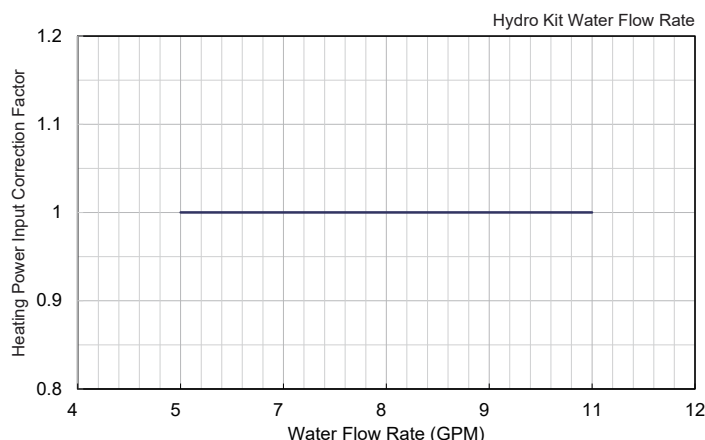
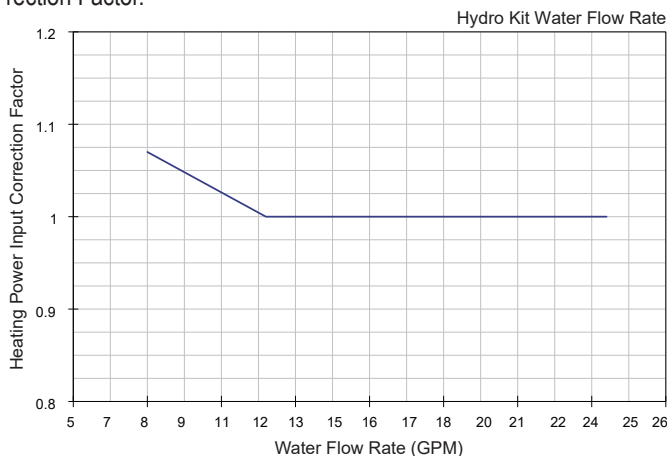


Figure 18: ARNH923K2A4 Water Flow Rate Power Input Heating Correction Factor.



SELECTION PROCESS

Hydro Kits with Multi V 5 and Multi V S Air-Source Systems

Water Pressure Drop

Calculating the Heat Exchanger Water Pressure Drop

To obtain the Hydro Kit Water Pressure Drop (with antifreeze), use:

$$\text{Water Pressure Drop} \times \text{Factor P} = \text{Antifreeze / Water Solution Heat Exchanger Waterside Pressure Drop (ft.-w.g.)}$$

Where Factor P = Antifreeze Additive (% by Weight) Waterside Pressure Drop Correction Factor

Determine the system design water flow rate. Because the pump must be sized for the worst case scenario, choose the highest flow rate through the heat exchanger - cooling or heating mode.

1. Find the design water flow (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit flow rate.
3. Use the intersecting datapoint to find the waterside pressure drop through the heat exchanger using water without any antifreeze.
4. If the application warrants antifreeze, apply the antifreeze pressure drop correction factor found in the table below.
5. Find the type of antifreeze used, and find the percentage of antifreeze by weight for the solution. The intersecting datapoint is the "Antifreeze Additive (% by Weight) Waterside Pressure Drop Correction Factor" to be used in the formula above.

Figure 19: ARNH423K2A4 Hydro Kit Heat Exchanger Water Pressure Drop.

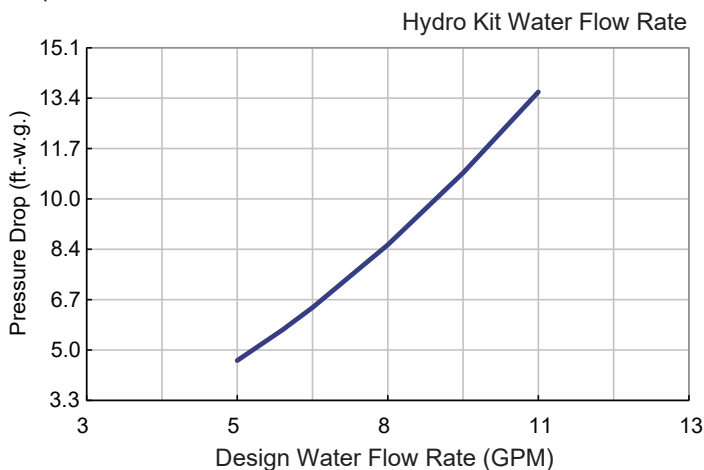


Figure 20: ARNH963K2A4 Hydro Kit Heat Exchanger Water Pressure Drop.

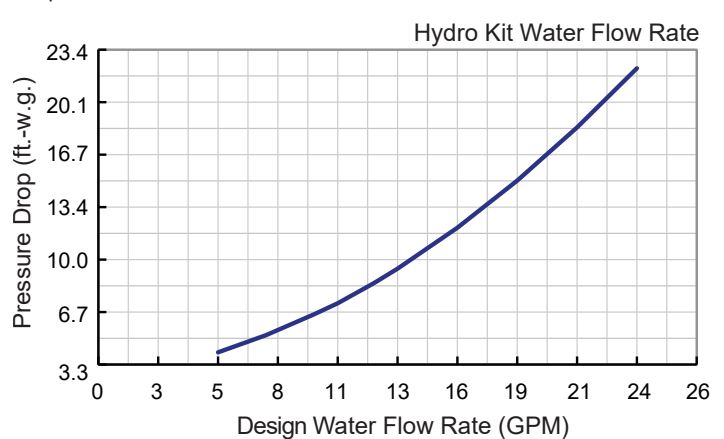


Table 13: Water Pressure Drop Correction Factors.

Type	Antifreeze Concentration Level (% by Weight)				
	10%	20%	30%	40%	50%
Methanol	1.023	1.057	1.091	1.122	1.160
Ethylene Glycol	1.024	1.068	1.124	1.188	1.263
Propylene Glycol	1.040	1.098	1.174	1.273	1.405

Hydro Kits with Multi V 5 and Multi V S Air-Source Systems Combination Ratio Limits

Operation Limits

The Hydro Kit's outdoor ambient temperature operational limitations are defined by the Multi V outdoor unit serving the system. For more information on operation limits, refer to the Multi V 5 or Multi V S Outdoor Engineering Manuals.

Cooling Operation Limits

Figure 21: ARNH423-963K2A4 Cooling Operation Limits with Multi V 5 and Multi V S Heat Pump Outdoor Units.

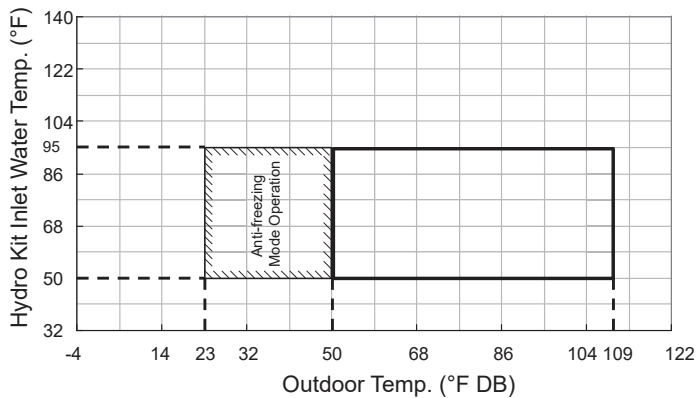
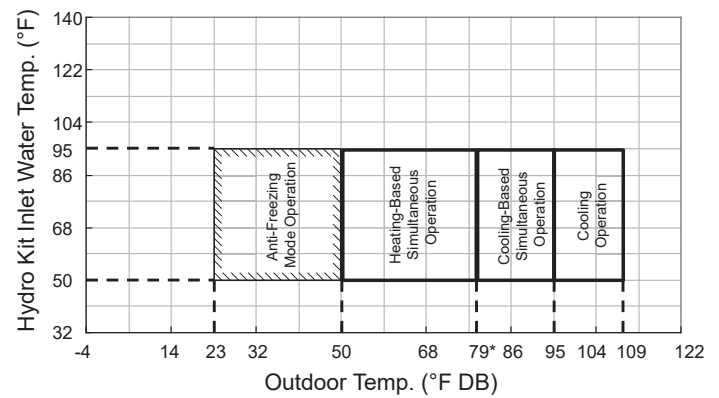


Figure 22: ARNH423-963K2A4 Cooling Operation Limits with Multi V 5 and Multi V S Heat Recovery Outdoor Units.



The 79°F DB corresponds to 60.8°F WB.

Heating Operation Limits

Figure 23: ARNH423-963K2A4 Heating Operation Limits with Multi V 5 or Multi V S Heat Pump Outdoor Units.

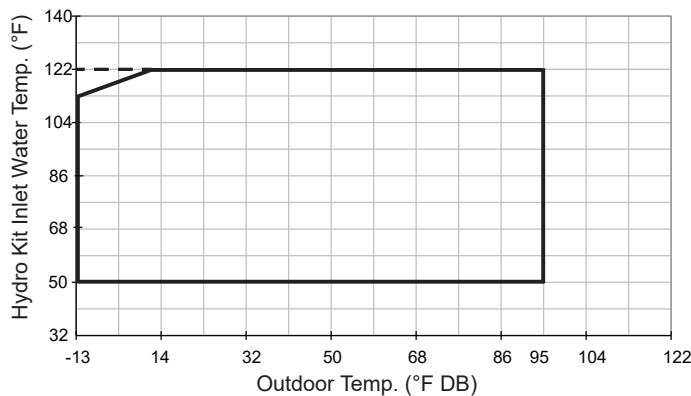
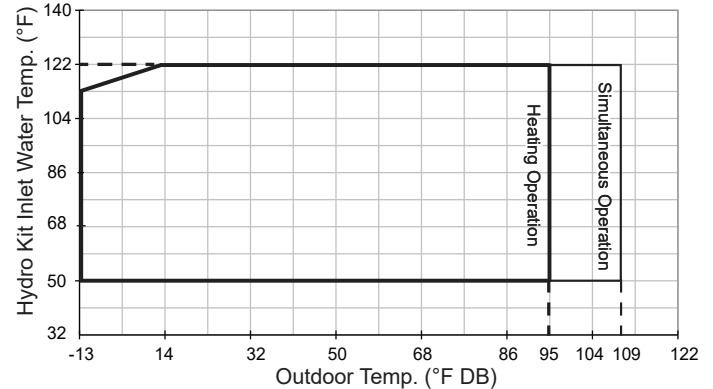


Figure 24: ARNH423-963K2A4 Heating Operation Limits with Multi V 5 or Multi V S Heat Recovery Outdoor Units.



Note

- If a system has all Hydro Kits, the maximum outdoor temperature operation limit is 95°F.
- Simultaneous operation means that some indoor units are operating in heating.

SELECTION PROCESS



Hydro Kits with Multi V 5 and Multi V S Air-Source Systems

Combination Ratio Limits

Combination Ratio Limits

See the charts below for capacity correction and power input correction factors when the combination ratio of Hydro Kits to total combination capacity is considered. See table below for the maximum combination ratios of systems with all Hydro Kits or Hydro Kits combined with indoor units.

Figure 25: ARNH423-963K2A4 Capacity Correction Factor of Hydro Kits to Total Combination Capacity.

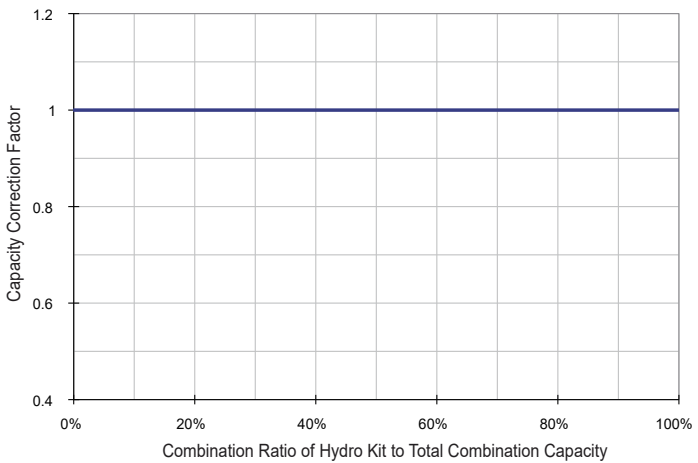


Figure 26: ARNH423-963K2A4 Power Input Correction Factor of Hydro Kits to Total Combination Capacity.

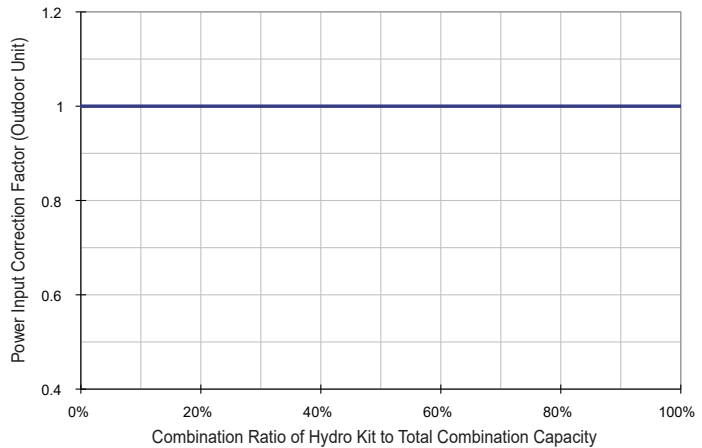


Table 14: Maximum Combination Ratios of Hydro Kits With or Without Indoor Units.

Maximum Combination Ratio (Heat Pump, Heat Recovery)	
Hydro Kit Only	Hydro Kit + Indoor Unit
50% - 100%	50% - 130%

1. If the combination ratio of operating indoor units ratio to the outdoor unit rated capacity is more than 130%, the airflow rate or the capacity of all indoor units and the hydro kit reduces to the lower range of operation.
2. The total capacity index of indoor units combined with Hydro Kits corresponds to the maximum combination ratio of the outdoor unit, but the capacity index of just Hydro Kits cannot be more than 100% of the capacity index of the outdoor unit.
3. Hydro Kits cannot be combined with Multi V S 24k outdoor units.



SELECTION PROCESS FOR WATER-SOURCE SYSTEMS (MULTI V WATER IV)

Applying Correction Factors on page 32

Operation Limits on page 40

SELECTION PROCESS

Hydro Kits with Multi V IV Water-Source Systems

Applying Cooling Capacity and Power Input Correction Factors

Capacity Correction Factor by Temperature

Capacity Calculation Methods

Hydro Kit Capacity + Indoor Unit Capacity = Total Capacity

$$Q_{\text{ODU}} \times (I_{\text{HK}} / I_{\text{TOTAL}}) \times F_{\text{TC,T_HK}} \times F_{\text{TC,W_HK}} \times F_{\text{TC,C_HK}} \times F_{\text{TC,P_ODU}} \times F_{\text{TC,D_ODU}} = \text{Hydro Kit Capacity}$$

QODU = Water-Source Unit Capacity by Inlet Water temperature, and capacity ratio at standard indoor temperature. Standard indoor temperature is 80.6°F DB / 66.2°F WB on cooling mode, 68°F DB on heating mode. Refer to the capacity tables of the Multi V IV water-source unit.

$F_{\text{TC,T_HK}}$ = Capacity Correction Factor by Water Inlet Temperature (See Figures 27 and 35).

$F_{\text{TC,W_HK}}$ = Capacity Correction Factor by Water Flow Rate (Figures 28 and 29, and Figures 36 and 37).

$F_{\text{TC,C_HK}}$ = Capacity Correction Factor by Combination Ratio (See Pages 40 and 41).

$F_{\text{TC,P_ODU}}$ = Capacity Correction Factor by Refrigerant Piping Length (Refer to the correction factors of the water-source unit. For Hydro Kit applications, it will always be one [1]).

I_{HK} = Capacity Index for Hydro Kit (See Page 10).

I_{TOTAL} = Sum of Capacity Index for Hydro Kits Combined with Indoor Units (See Table 17).

Power Input Calculation Methods

Hydro Kit Power Input + Indoor Unit Power Input = Total Power Input

$$P_{\text{IODU}} \times (I_{\text{HK}} / I_{\text{TOTAL}}) \times F_{\text{PI,T_HK}} \times F_{\text{PI,W_HK}} \times F_{\text{PI,C_HK}} = \text{Hydro Kit Power Input}$$

P_{IODU} = Water-Source Unit Power Input by Inlet Water temperature, and capacity ratio at standard indoor temperature. Standard indoor temperature is 80.6°F DB / 66.2°F WB on cooling mode, 68°F DB on heating mode.

$F_{\text{PI,T_HK}}$ = Power Input Correction Factor by Water Inlet Temperature. (See Figures 32 and 39).

$F_{\text{PI,W_HK}}$ = Power Input Correction Factor by Water Flow Rate (See Figures 33 and 34, and Figures 40 and 41).

$F_{\text{PI,C_HK}}$ = Power Input Correction Factor by Combination Ratio (See Pages 40 and 41).

I_{HK} = Capacity Index for Hydro Kit (See Page 10).

I_{TOTAL} = Sum of Capacity Index for Hydro Kits Combined with Indoor Units (See Table 17).

When calculating at maximum and minimum temperatures of the outdoor unit capacity range and power input, use the same temperature values for both.

For example, when calculating Heating PI with capacity table of Multi V IV Heat Pump at 59°F DB, use the same value of PI at 59°F DB.

To apply and choose a Hydro Kit for use with Multi V IV Water-Source systems (by March 1, 2019), the designer needs to know the corrected cooling capacity (Btu/h), the cooling power input (kW), the corrected heating capacity (Btu/h), the heating power input (kW), water pressure drop through the heat exchanger (ft.-w.g.), and combination ratio limits. The following pages present the necessary steps and processes to obtain all the information needed.

Note:

The ARNH-K2A4 Hydro Kits can be used with outdoor units manufactured after April 2019 communicating at a baud rate of 9,600 bps (Gen4 features are operational). Before April 2019, outdoor units communicate at a baud rate of 1,200 bps. For more information, review the specific outdoor unit Engineering and Installation Manuals, or contact your LG Sales Representative.

Calculating Corrected Cooling Capacity

To obtain the corrected cooling capacity at design conditions, first see the "Hydro Kit Specifications Table" on page 10, and find the rated cooling capacity of the chosen Hydro Kit. Use the charts on the following pages for the three (3) additional factors needed to determine the corrected cooling capacity:

- Factor A = Inlet Water Temperature (°F) (Multi V IV Water-Source).
- Factor B = Water Flow Rate (GPM).
- Factor C = Antifreeze Additive (% by Weight).

Then, to calculate, use:

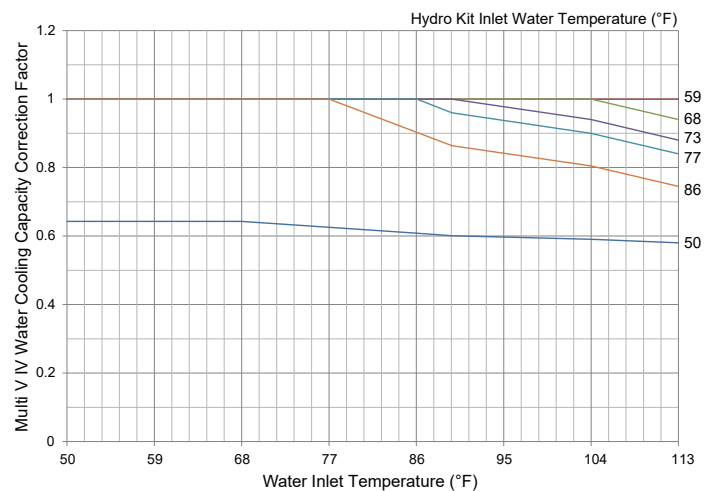
Rated Capacity (Btu/h) x Factor A x Factor B x Factor C = Corrected Cooling Capacity (Btu/h).

Cooling Capacity Correction Charts for Multi V IV Water-Source Units

Factor A: Inlet Water Temperature (°F)

1. Find the water inlet temperature on the chart.
2. Find the Hydro Kit inlet water temperature.
3. Use the intersecting datapoints to find the cooling capacity correction factor by water-source unit inlet water temperature.

Figure 27: Multi V IV Water-Source Cooling Capacity Correction Factor Chart.



SELECTION PROCESS

Hydro Kits with Multi V IV Water-Source Systems

Applying Cooling Capacity and Power Input Correction Factors

Factor B: Water Flow Rate (GPM)

1. Find the cooling design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the cooling capacity correction factor by water flow rate.

Figure 28: ARNH423K2A4 Water Flow Rate Cooling Capacity Correction Factor.

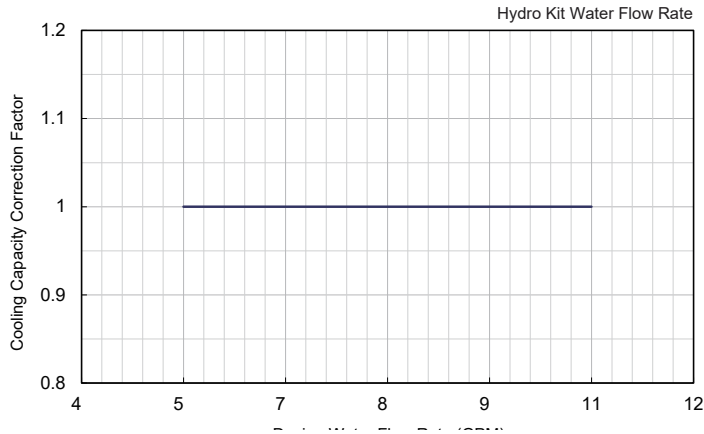
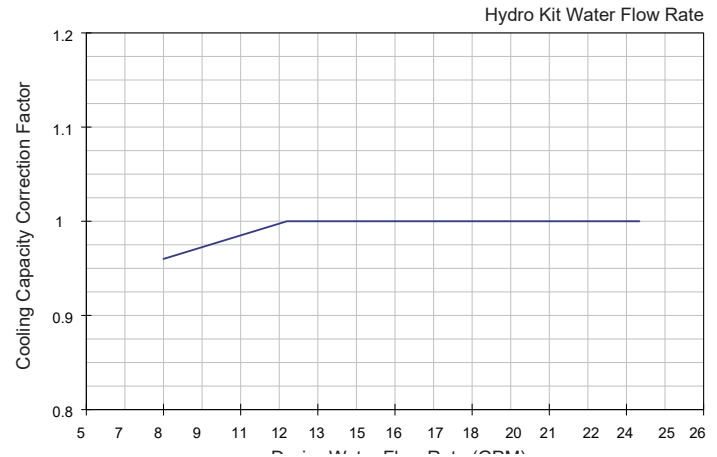


Figure 29: ARNH923K2A4 Water Flow Rate Cooling Capacity Correction Factor.



Factor C: Antifreeze Additive (% by Weight)

If the water flowing through the Hydro Kit heat exchanger has the potential to freeze, an antifreeze agent such as ethylene glycol, propylene glycol, or methanol must be added to the water circuit. The antifreeze will reduce the ability of the Hydro Kit to exchange heat energy, and this reduction must be taken into account.

1. Find the antifreeze percent by weight on the chart.
2. Find the antifreeze being considered.
3. Use the intersecting datapoint to find the cooling capacity correction factor. See also table below for cooling capacity correction factor datapoints at specific antifreeze concentration level percentages.

Figure 30: Cooling Capacity Correction by % Antifreeze.

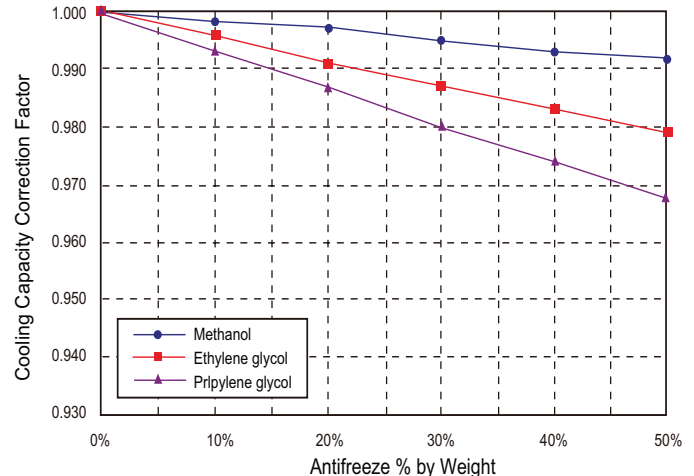


Figure 31: Cooling Capacity Correction by % Antifreeze Chart.

Type	Antifreeze Concentration Level (% by Weight)				
	10%	20%	30%	40%	50%
Methanol	0.998	0.997	0.995	0.993	0.992
Ethylene Glycol	0.996	0.991	0.987	0.983	0.979
Propylene Glycol	0.993	0.987	0.980	0.974	0.968

Calculating Corrected Cooling Power Input

To obtain the corrected cooling power input, first see the “Hydro Kit Electrical Data Table” on page 11, and find the rated cooling power input of the chosen Hydro Kit. Use the charts on the following pages for the two (2) additional factors needed to determine the corrected cooling power input:

- Factor D = Inlet Water Temperature (°F) (Multi V IV Water-Source).
- Factor E = Water Flow Rate (GPM).

Then, to calculate, use:

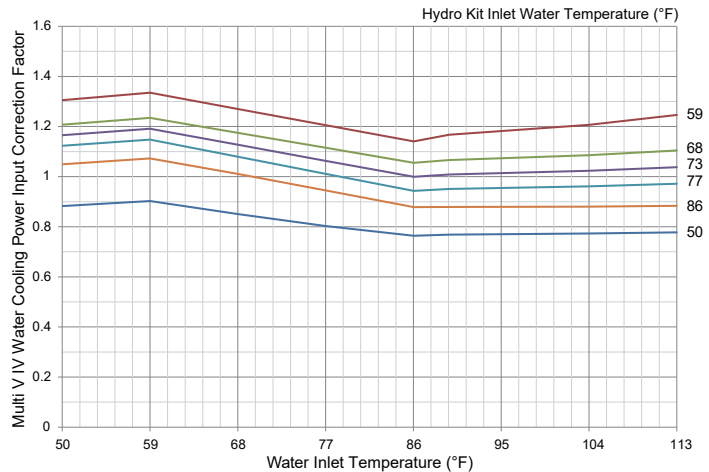
$$\text{Rated Capacity (kW)} \times \text{Factor D} \times \text{Factor E} = \text{Corrected Cooling Power Input (kW)}$$

Cooling Power Input Charts for Multi V IV Water-Source Units

Factor D: Inlet Water Temperature (°F)

1. Find the design water inlet temperature in the chart at right.
2. Find the Hydro Kit inlet water temperature.
3. Use the intersecting datapoint to find the cooling power input correction factor.

Figure 32: Multi V IV Water-Source Cooling Power Input Capacity Correction Factor Chart.



Factor E: Water Flow Rate (GPM)

1. Find the cooling design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the cooling power input correction factor by water flow rate.

Figure 33: ARNH423K2A4 Water Flow Rate Power Input Heating Correction Factor.

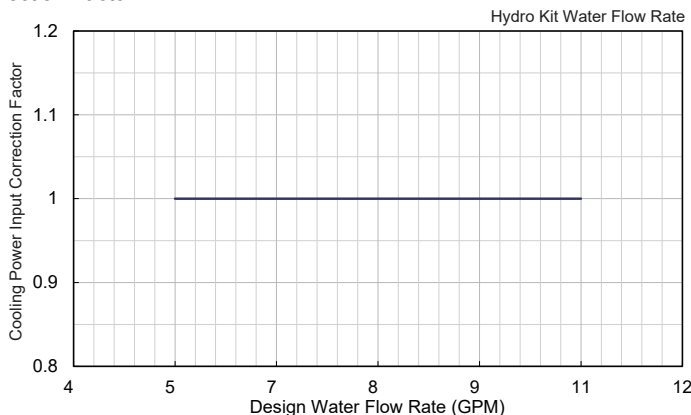
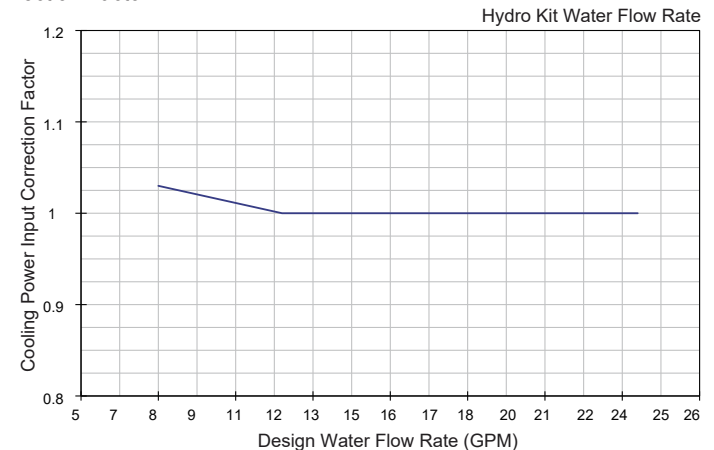


Figure 34: ARNH923K2A4 Water Flow Rate Power Input Heating Correction Factor.



SELECTION PROCESS



Hydro Kits with Multi V IV Water-Source Systems

Applying Heating Capacity and Power Input Correction Factors

Calculating Corrected Heating Capacity

To obtain the corrected heating capacity at design conditions, first see the “Hydro Kit Specifications Table” on page 10, and find the rated heating capacity of the chosen Hydro Kit. Use the charts on the following pages for the three (3) additional factors needed to determine the corrected heating capacity:

- Factor A = Inlet Water Temperature (°F) (Multi V IV Water-Source).
- Factor B = Water Flow Rate (GPM).
- Factor C = Antifreeze Additive (% by Weight).

Then, to calculate, use:

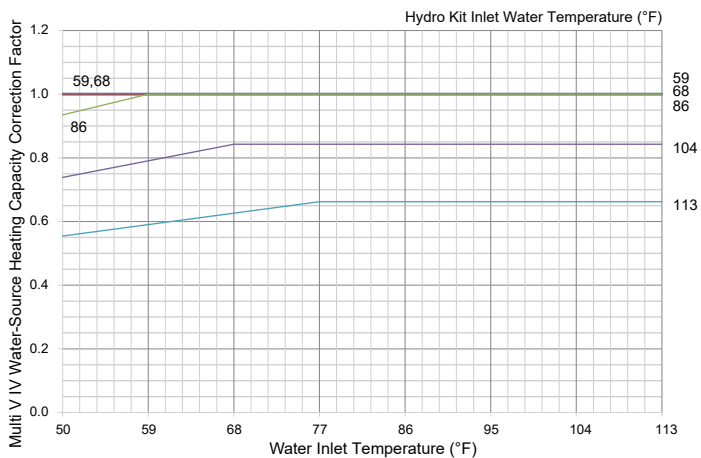
$$\text{Rated Capacity (Btu/h)} \times \text{Factor A} \times \text{Factor B} \times \text{Factor C} = \text{Corrected Heating Capacity (Btu/h)}.$$

Heating Capacity Correction Charts for Multi V IV Water-Source Units

Factor A: Inlet Water Temperature (°F)

1. Find the water inlet temperature on the chart.
2. Find the Hydro Kit inlet water temperature.
3. Use the intersecting datapoints to find the heating capacity correction factor by water-source inlet water temperature.

Figure 35: Multi V IV Water-Source Heating Capacity Correction Factor Chart.



Factor B: Water Flow Rate (GPM)

1. Find the heating design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the heating capacity correction factor by water flow rate.

Figure 36: ARNH423K2A4 Water Flow Rate Heating Capacity Correction Factor.

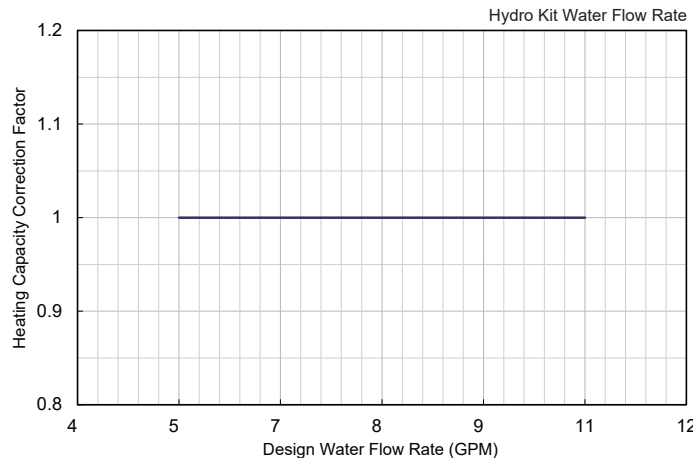
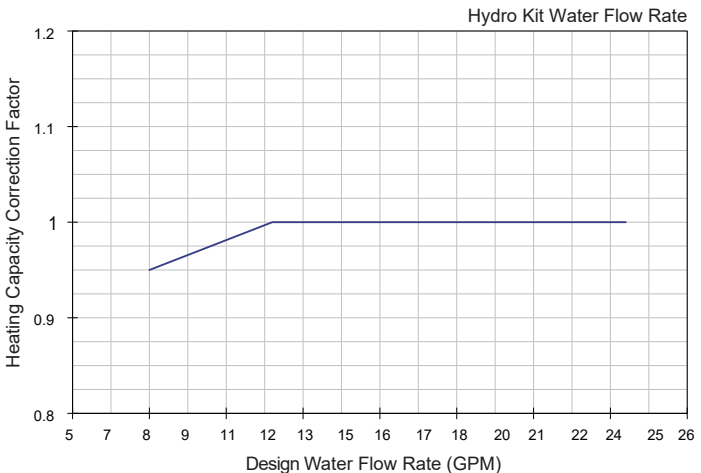


Figure 37: ARNH923K2A4 Water Flow Rate Heating Capacity Correction Factor.



Factor C: Antifreeze Additive (% by Weight)

If the water flowing through the Hydro Kit heat exchanger has the potential to freeze, an antifreeze agent such as ethylene glycol, propylene glycol, or methanol must be added to the water circuit. The antifreeze will reduce the ability of the Hydro Kit to exchange heat energy, and this reduction must be taken into account.

1. Find the antifreeze percent by weight on the chart.
2. Find the antifreeze being considered.
3. Use the intersecting datapoint to find the heating capacity correction factor. See also table below for heating capacity correction factor datapoints at specific antifreeze concentration level percentages.

Figure 38: Heating Capacity Correction Factor by Water Flow Rate.

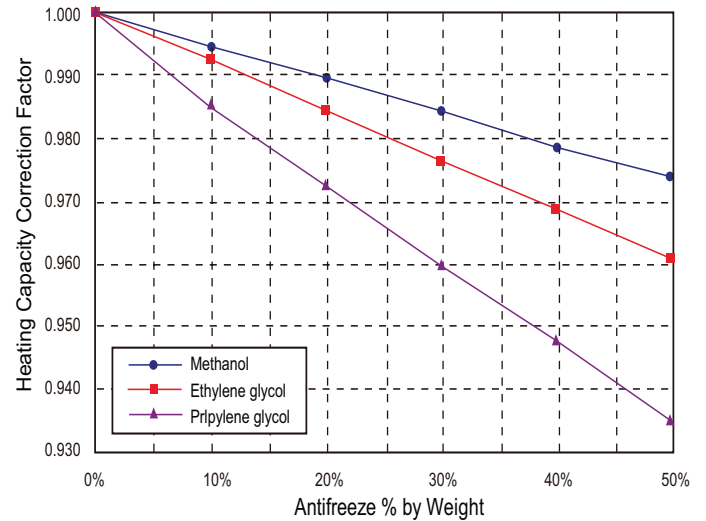


Table 15: Heating Capacity Correction by % Antifreeze Chart.

Type	Antifreeze Concentration Level (% by Weight)				
	10%	20%	30%	40%	50%
Methanol	0.995	0.990	0.985	0.979	0.974
Ethylene Glycol	0.993	0.985	0.977	0.969	0.961
Propylene Glycol	0.966	0.973	0.960	0.948	0.935

SELECTION PROCESS



Hydro Kits with Multi V IV Water-Source Systems

Applying Heating Capacity and Power Input Correction Factors

Calculating Corrected Heating Power Input

To obtain the corrected heating power input, first see the “Hydro Kit Electrical Data Table” on page 17, and find the rated heating power input of the chosen Hydro Kit. Use the charts on the following pages for the two (2) additional factors needed to determine the corrected heating power input:

- Factor D = Inlet Water Temperature (°F) (Multi V IV Water-Source).
- Factor E = Water Flow Rate (GPM).

Then, to calculate, use:

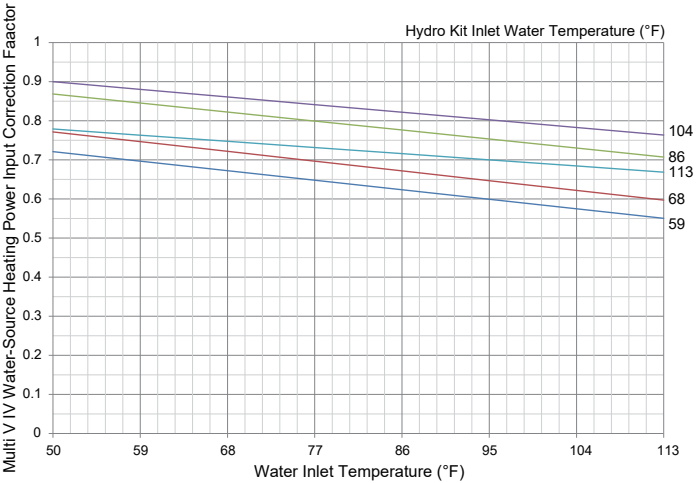
$$\text{Rated Capacity (kW)} \times \text{Factor D} \times \text{Factor E} = \text{Corrected Heating Power Input (kW)}$$

Heating Power Input Charts for Multi V IV Water-Source Units

Factor D: Inlet Water Temperature (°F)

1. Find the design water inlet temperature.
2. Find the Hydro Kit inlet water temperature.
3. Use the intersecting datapoint to find the heating power input correction factor.

Figure 39: Multi V IV Water-Source Heating Power Input Capacity Correction Factor Chart.



Factor E: Water Flow Rate (GPM)

1. Find the heating design water flow rate (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit water flow rate.
3. Use the intersecting datapoint to find the heating power input correction factor by water flow rate.

Figure 40: ARNH423K2A4 Water Flow Rate Power Input Heating Correction Factor.

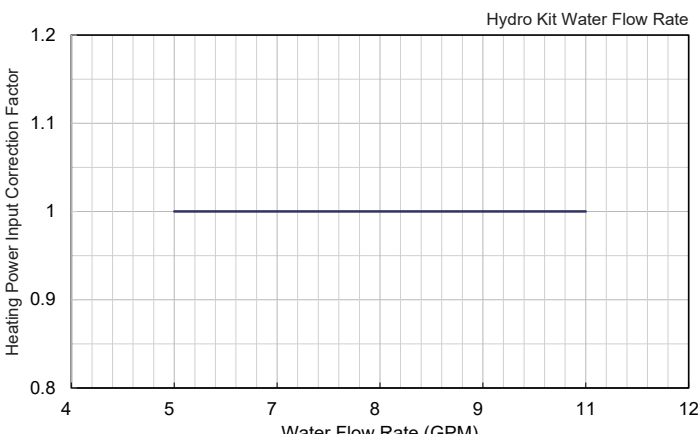
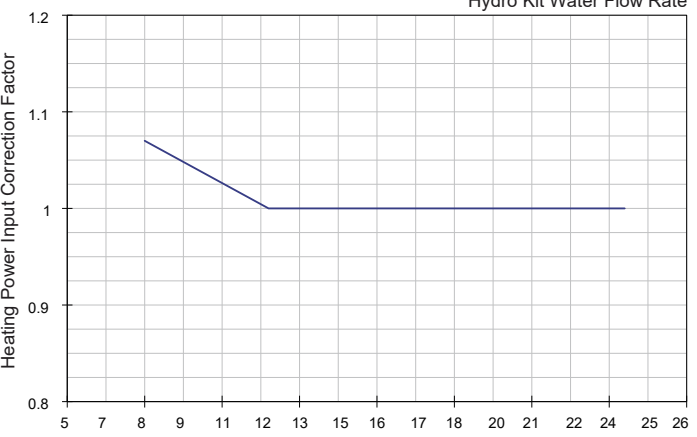


Figure 41: ARNH923K2A4 Water Flow Rate Power Input Heating Correction Factor.



Calculating the Heat Exchanger Water Pressure Drop

To obtain the Hydro Kit Water Pressure Drop (with antifreeze), use:

Water Pressure Drop x Factor P = Antifreeze / Water Solution Heat Exchanger Waterside Pressure Drop (ft.-w.g.)

Where Factor P = Antifreeze Additive (% by Weight) Waterside Pressure Drop Correction Factor

Determine the system design water flow rate. Because the pump must be sized for the worst case scenario, choose the highest flow rate through the heat exchanger - cooling or heating mode.

1. Find the design water flow (GPM) on the chart for the proposed Hydro Kit model below.
2. Find the Hydro Kit flow rate.
3. Use the intersecting datapoint to find the waterside pressure drop through the heat exchanger using water without any antifreeze.
4. If the application warrants antifreeze, apply the antifreeze pressure drop correction factor found in the table below.
5. Find the type of antifreeze used, and find the percentage of antifreeze by weight for the solution. The intersecting datapoint is the "Antifreeze Additive (% by Weight) Waterside Pressure Drop Correction Factor" to be used in the formula above.

Figure 42: ARNH423K2A4 Hydro Kit Heat Exchanger Water Pressure Drop.

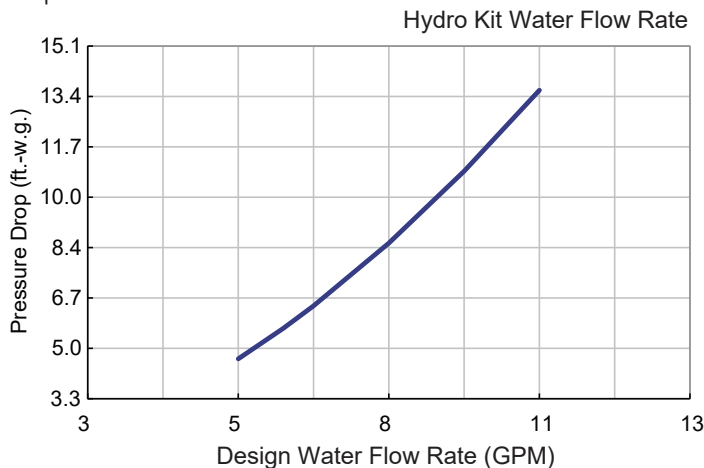


Figure 43: ARNH963K2A4 Hydro Kit Heat Exchanger Water Pressure Drop.

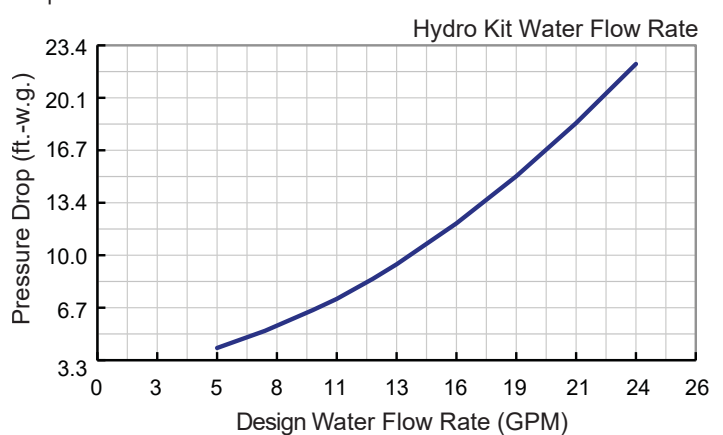


Table 16: Water Pressure Drop Correction Factors.

Type	Antifreeze Concentration Level (% by Weight)				
	10%	20%	30%	40%	50%
Methanol	1.023	1.057	1.091	1.122	1.160
Ethylene Glycol	1.024	1.068	1.124	1.188	1.263
Propylene Glycol	1.040	1.098	1.174	1.273	1.405

SELECTION PROCESS



Hydro Kits with Multi V IV Water-Source Systems

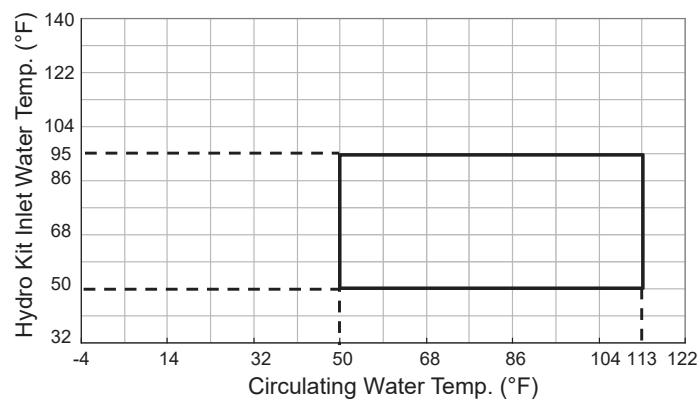
Combination Ratio Limits

Operation Limits

The Hydro Kit's condenser circuit water temperature operational limitations are defined by the Multi V outdoor unit serving the system. For more information on operation limits, refer to the Multi V IV Water-Source Engineering Manual.

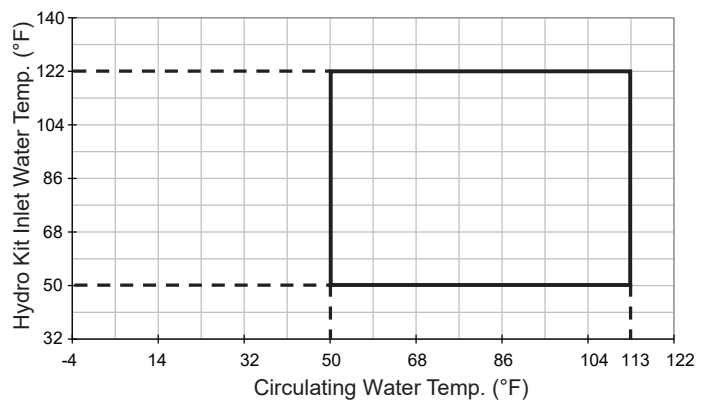
Cooling Operation Limits

Figure 44: ARNH423-963K2A4 Cooling Operation Limits for Multi V IV Heat Pump and Heat Recovery Water Units.



Heating Operation Limits

Figure 45: ARNH423-963K2A4 Heating Operation Limits for Multi V IV Heat Pump and Heat Recovery Water Units.



Combination Ratio Limits

See the charts below for capacity correction and power input correction factors when the combination ratio of Hydro Kits to total combination capacity is considered. See table below for the maximum combination ratios of systems with all Hydro Kits or Hydro Kits combined with indoor units.

Figure 46: ARNH423-963K2A4 Capacity Correction Factor of Hydro Kits to Total Combination Capacity.

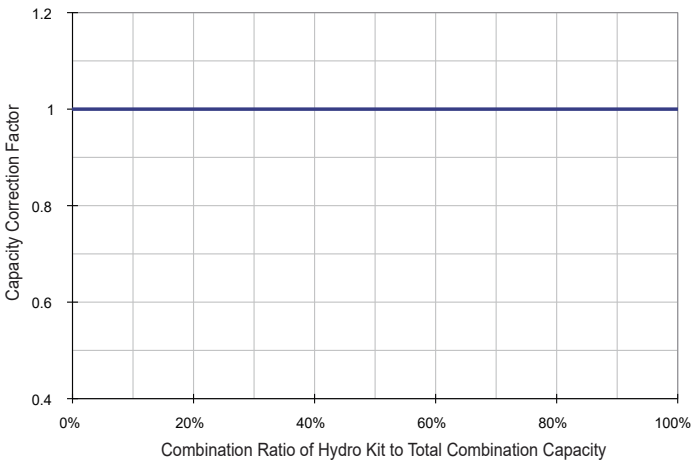


Figure 47: ARNH423-963K2A4 Power Input Correction Factor of Hydro Kits to Total Combination Capacity.

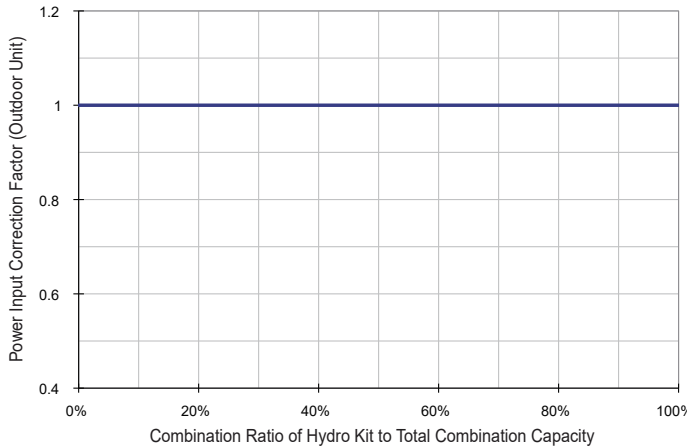


Table 17: Maximum Combination Ratios of Hydro Kits With or Without Indoor Units.

Maximum Combination Ratio (Heat Pump, Heat Recovery)	
Hydro Kit Only	Hydro Kit + Indoor Unit
50% - 100%	50% - 130%

1. If the combination ratio of operating indoor units ratio to the outdoor unit rated capacity is more than 130%, the airflow rate or the capacity of all indoor units and the hydro kit reduces to the lower range of operation.
2. The total capacity index of indoor units combined with Hydro Kits corresponds to the maximum combination ratio of the outdoor unit, but the capacity index of just Hydro Kits cannot be more than 100% of the capacity index of the outdoor unit.
3. Hydro Kits cannot be combined with Multi V S 24k outdoor units.

Inverter



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Alpharetta, Georgia 30022
www.lghvac.com

EM_HydroKit_K2A4_05_21
Supersedes: EM_HydroKit_K2A4_11_19
VRF-EM-BT-001-US 013K31